7590-01-P

Nuclear Regulatory Commission

10 CFR Part 51

[Docket ID-2008-0482]

Waste Confidence Decision Update

AGENCY: Nuclear Regulatory Commission.

ACTION: Update and final revision of Waste Confidence Decision.

SUMMARY: On September 18, 1990 (55 FR 38474), the Nuclear Regulatory Commission (NRC or Commission) issued a decision reaffirming and revising, in part, the five Waste Confidence findings reached in its 1984 Waste Confidence Decision. The 1984 decision and the 1990 review were products of rulemaking proceedings designed to assess the degree of assurance that radioactive wastes generated by nuclear power plants can be safely disposed of, to determine when such disposal or offsite storage would be available, and to determine whether radioactive wastes can be safely stored onsite past the expiration of existing facility licenses until offsite disposal or storage is available. In 2008, the Commission decided to again undertake a review of its Waste Confidence findings as part of an effort to enhance the efficiency of combined license proceedings for applications for nuclear power plants anticipated in the near future by ensuring that the findings are up-to-date.

The Commission has reviewed its five findings and the rationale for them in light of developments since 1990. This updated Waste Confidence Decision supplements those 1990

findings and the environmental analysis supporting them. The Commission is revising the second and fourth findings in the Waste Confidence Decision as follows:

Finding 2: The Commission finds reasonable assurance that sufficient mined geologic repository capacity will be available within 50-60 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of any reactor to dispose of the commercial high-level radioactive waste and spent fuel originating in such reactor and generated up to that time.

Finding 4: The Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely without significant environmental impacts for at least 60 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor in a combination of storage in its spent fuel storage basin and either onsite or offsite independent spent fuel storage installations.

The Commission reaffirms the remaining findings. Each finding and the reasons for revising or reaffirming the finding are discussed below. In keeping with revised Findings 2 and 4, the Commission is publishing concurrently in this issue of the *Federal Register* conforming amendments to its 10 CFR Part 51 rule providing its generic determination on the environmental impacts of storage of spent fuel at, or away from, reactor sites after the expiration of reactor operating licenses.

ADDRESSES: You can access publicly available documents related to this document using the following methods:

Federal e-Rulemaking Portal: Go to *http://www.regulations.gov* and search for documents filed under Docket ID [NRC-2008-0019]. Address questions about NRC Dockets to Carol Gallagher at 301-492-3668; e-mail *Carol.Gallagher@nrc.gov*.

NRC's Public Document Room (PDR): The public may examine and have copied for a fee publicly available documents at the NRC's PDR, Public File Area O1 F21, One White Flint North, 11555 Rockville Pike, Rockville, Maryland.

NRC's Agency Wide Documents Access and Management System (ADAMS): Publicly available documents created or received at the NRC are available electronically at the NRC's Electronic Reading Room at *http://www.nrc.gov/reading-rm/adams.html*. From this page, the public can gain entry into ADAMS, which provides text and image files of the NRC's public documents. If you do not have access to ADAMS or if there are problems in accessing the documents located in ADAMS, contact the NRC's PDR reference staff at 1-800-397-4209, 301-415-4737 or by e-mail to *pdr.resource@nrc.gov*.

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Issue 1: Compliance of the Waste Confidence Decision with the National Environmental Policy Act (NEPA)

Issue 2: Compliance of the Waste Confidence Decision with the Atomic Energy Act (AEA)

Issue 3: What is the meaning of “reasonable assurance” in the Waste Confidence findings?

Issue 4: Whether the Commission has an adequate basis for reaffirming Finding 1

Issue 5: Whether the Commission has an adequate basis to revise Finding 2

Issue 6: Whether the Commission has an adequate basis to reaffirm Finding 3

Issue 7: Whether the Commission has an adequate basis for finding that SNF generated in any reactor can be stored safely and securely and without significant environmental impact for at least 60 years.

Issue 8: Miscellaneous Comments

I. Finding 1: The Commission finds reasonable assurance that safe disposal of high-level radioactive waste and spent fuel in a mined geologic repository is technically feasible.

A. Bases for Finding 1.

B. Evaluation of Finding 1.

II. Finding 2 (1990): The Commission finds reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and that sufficient repository capacity will be available within 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of any reactor to dispose of the commercial high-level radioactive waste and spent fuel originating in such reactor and generated up to that time.

A. Bases for Finding 2.

B. Evaluation of Finding 2.

C. Finding 2.

III. Finding 3: The Commission finds reasonable assurance that HLW and spent fuel will be managed in a safe manner until sufficient repository capacity is available to assure the safe disposal of all HLW and spent fuel.

A. Bases for Finding 3.

B. Evaluation of Finding 3.

IV. Finding 4 (1990): The Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations.

A. Bases for Finding 4.

B. Evaluation of Finding 4.

C. Finding 4

V. Finding 5: The Commission finds reasonable assurance that safe independent onsite spent fuel storage or offsite spent fuel storage will be made available if such storage capacity is needed.

A. Bases for Finding 5.

B. Evaluation of Finding 5.

SUPPLEMENTARY INFORMATION:

Background

In October 1979, the NRC initiated a rulemaking proceeding, known as the Waste Confidence proceeding, to assess its degree of assurance that radioactive wastes produced by nuclear power plants (NPPs) "can be safely disposed of, to determine when such disposal or offsite storage will be available, and to determine whether radioactive wastes can be safely stored onsite past the expiration of existing facility licenses until offsite disposal or storage is available" (44 FR 61372, 61373; October 25, 1979). The Commission's action responded to a remand from the U.S. Court of Appeals for the District of Columbia Circuit in *State of Minnesota*

v. NRC, 602 F.2d 412 (D. C. Cir.1979). That case raised the question of whether an offsite storage or disposal solution would be available for the spent nuclear fuel (SNF) produced at the Vermont Yankee and Prairie Island reactors at the expiration of the licenses for those facilities in the 2007-2009 period or, if not, whether the SNF could be stored at those reactor sites until an offsite solution was available. The Waste Confidence proceeding also stemmed from the Commission's statement, in its denial of a petition for rulemaking filed by the Natural Resources Defense Council (NRDC), that it intended to reassess periodically its finding of reasonable assurance that methods of safe permanent disposal of high-level radioactive waste (HLW) would be available when they were needed. Further, the Commission stated that, as a matter of policy, it "would not continue to license reactors if it did not have reasonable confidence that the wastes can and will in due course be disposed of safely." (42 FR 34391, 34393; July 5, 1977, *pet. for rev. dismissed sub nom., NRDC v. NRC*, 582 F.2d 166 (2d Cir. 1978)).[1]

The Waste Confidence proceeding resulted in the following five Waste Confidence findings, which the Commission issued August 31, 1984 (49 FR 34658; August 31, 1984).

(1) The Commission finds reasonable assurance that safe disposal of HLW and SNF in a mined geologic repository is technically feasible;

(2) The Commission finds reasonable assurance that one or more mined geologic repositories for commercial HLW and SNF will be available by the years 2007-2009 and that sufficient repository capacity will be available within 30 years beyond the expiration of any

[1] The NRDC petition asserted that the Atomic Energy Act of 1954, as amended (AEA), required NRC to make a finding, before issuing an operating license for a reactor, that permanent disposal of HLW generated by that reactor can be accomplished safely. The Commission found that the AEA did not require this safety finding to be made in the context of reactor licensing, but rather in the context of the licensing of a geologic disposal facility.

reactor operating license to dispose of existing commercial HLW and SNF originating in such reactor and generated up to that time;

(3) The Commission finds reasonable assurance that HLW and SNF will be managed in a safe manner until sufficient repository capacity is available to assure the safe disposal of all HLW and SNF;

(4) The Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the expiration of that reactor's operating license at that reactor's spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations (ISFSIs);

(5) The Commission finds reasonable assurance that safe independent onsite or offsite spent fuel storage will be made available if such storage capacity is needed.

Based on these findings, the Commission amended 10 CFR Part 51 of its regulations to provide a generic determination, codified in 10 CFR 51.23(a), that for at least 30 years beyond the expiration of reactor operating licenses, no significant environmental impacts will result from the storage of spent fuel in reactor facility storage pools or ISFSIs located at reactor or away-from-reactor sites.

The Commission conducted a review of its findings in 1989-1990, which resulted in the revision of the second and fourth findings to reflect revised expectations for the date of availability of the first repository, and to clarify that the expiration of a reactor's operating license referred to the full 40-year initial license for operation, as well as any additional term of a revised or renewed license. Those findings stated:

(2) The Commission finds reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and sufficient repository capacity will be available within 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of any reactor to dispose of the commercial HLW and SNF originating in such reactor and generated up to that time;

(4) The Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin, or at either onsite or offsite ISFSIs.

The Commission amended the generic determination made in 10 CFR 51.23(a) consistent with these revised findings (55 FR 38472; September 18, 1990):

> The Commission has made a generic determination that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin or at either onsite or offsite [ISFSIs]. Further, the Commission believes there is reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and sufficient repository capacity will be available within 30 years beyond the licensed life for operation of any reactor to dispose of the commercial [HLW and SNF] originating in such reactor and generated up to that time.

This generic determination is applied in licensing proceedings conducted under 10 CFR Parts 50, 52, 54 and 72. *See* 10 CFR 51.23(b) (2009).

In 1999, the Commission reviewed its Waste Confidence findings and concluded that experience and developments since 1990 had confirmed the findings and made a

comprehensive reevaluation of the findings unnecessary. It also stated that it would consider undertaking such a reevaluation when the pending repository development and regulatory activities had run their course or if significant and pertinent unexpected events occurred, raising substantial doubt about the continuing validity of the Waste Confidence findings (64 FR 68005; December 6, 1999).

The Commission did not undertake the current review of the 1990 Waste Confidence Decision based on any finding or belief that the criteria put forth in 1999 had been met. However, the Commission is now preparing to conduct a significant number of proceedings on combined license (COL) applications for new reactors. The issue of waste confidence has been raised in some of those proceedings and may be raised in others. This has prompted the Commission to take a fresh look at its Waste Confidence findings to take into account developments since 1990. For this purpose, the Commission has prepared this update of the Waste Confidence findings and now makes the following revisions of Findings 2 and 4:

(2) The Commission finds reasonable assurance that sufficient mined geologic repository capacity will be available within 50-60 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of any reactor to dispose of the commercial HLW and SNF originating in such reactor and generated up to that time.

(4) The Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 60 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor in a combination of storage in its spent fuel storage basin and either onsite or offsite ISFSIs.

The update restates and supplements the bases for the earlier findings and considers the public comments received on the proposed revisions to the findings.

The Commission is also publishing concurrently in this issue of the *Federal Register* a final rule revising 10 CFR 51.23(a) to conform to the revisions of Findings 2 and 4.

Responses to Public Comments

Comments were received from environmental and other public interest organizations; the nuclear industry; States, local governments, an Indian Tribe, and inter-governmental organizations; and individuals. Comments from the 157 comment letters were organized under a total of 8 issues for purposes of this discussion. The issues include comments made in two form letters received from 1,990 and 941 commenters, respectively.

Issue 1: Compliance of the Waste Confidence Decision with the National Environmental Policy Act (NEPA)

Comment 1: A large number of commenters expressed the view that NRC has not complied with NEPA in issuing its proposed revisions to findings in the Waste Confidence Decision and to its generic determination in 10 CFR 51.23(a) on the environmental impacts of storage of spent fuel at, or away from, reactor sites after the expiration of reactor operating licenses because they believe that the revisions need to be supported by a Generic Environmental Impact Statement (GEIS). In the view of the National Resources Defense Council (NRDC), these two agency actions “are, in effect, generic licensing decisions that allow for the production of

additional spent reactor fuel and other radioactive wastes associated with the uranium fuel cycle — essentially in perpetuity." Thus, these "generic licensing decisions," in NRDC's view, must "be accompanied by a [GEIS] that fully assesses the environmental impacts of the entire uranium fuel cycle, including health and environmental impacts and costs, and that examines a reasonable array of alternatives, including the alternative of not producing any additional radioactive waste." Texans for a Sound Energy Policy (TSEP) states that "the NRC has relied on the Waste Confidence Decision to license and re-license many nuclear power plants, and therefore it constitutes a major federal action significantly affecting the environment", requiring preparation of an EIS. A form letter, used by many commenters, asserts "it is appropriate that any major federal action on radioactive waste (such as changing the Waste Confidence Decision) be considered in a generic (programmatic) NEPA proceeding" which includes all aspects of the nuclear fuel chain.

NRC Response: In considering NRC's compliance with NEPA in revising its Waste Confidence findings and temporary storage rule, it is important to keep in mind the limited scope of these revisions. The NRC is amending its generic determination of no significant environmental impact from the temporary storage of spent fuel after cessation of reactor operation contained in 10 CFR 51.23(a) to conform it to the Commission's revised Finding 4 of the Waste Confidence Decision. In revised Finding 4, the Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 60 years (rather than 30 years, as in the present finding) beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor in a combination of storage in its spent fuel storage basin and either onsite or offsite ISFSIs. The revised generic determination in 10 CFR 51.23(a) is dependent upon the environmental analysis supporting revised Finding 4. The 60 years reflects the Commission's

revised Finding 2 that reasonable assurance exists that sufficient mined geologic repository capacity will be available within 50-60 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of any reactor to dispose of the commercial HLW and SNF originating in such reactor and generated up to that time.[2]

The revised generic determination is not a generic licensing decision. It does not authorize the operation of a NPP, the renewal of a license of a NPP, or the production of spent fuel by a NPP. NPPs are licensed in individual licensing proceedings as are renewals of operating licenses. The NRC must prepare a site-specific EIS in connection with any type of application to construct and operate a NPP. *See* 10 CFR 51.20(b). The NRC may rely on NRC's *GEIS for License Renewal of Nuclear Plants, NUREG-1437*, May 1996, for issues that are common to all plants, *see* 10 CFR Part 51, Subpart A, Appendix B, but must also prepare a Supplemental EIS that evaluates site-specific issues not discussed in the GEIS or "new and significant information" regarding issues that are discussed in the GEIS.[3] Both types of licensing proceedings are supported by both generic and specific EISs. The generic determination in § 51.23(a) does play a role in the environmental analyses done for the licensing and re-licensing of individual NPPs insofar as it excuses applicants for those licenses and the NRC from conducting an additional environmental analysis *within the scope of the generic determination in § 51.23(a).* Thus, 10 CFR 51.23(b) provides:

[2] This reflects a prediction that a repository should be available in the 2050-2060 timeframe.

[3] The Commission has approved publication, scheduled for July 2009, of a proposed rule updating the 1996 GEIS for a 75-day public comment period.

> Accordingly, … within the scope of the generic determination in paragraph (a) of this section, no discussion of any environmental impact of spent fuel storage in reactor facility storage pools or [ISFSIs] *for the period following the term* of the reactor operating license or amendment, reactor combined license or amendment, or initial ISFSI license or amendment for which application is made, is required in any environmental report, [EIS], [EA], or other analysis prepared in connection with the issuance or amendment of an operating license for a [NPP] under parts 50 and 54 of this chapter, or issuance or amendment of a combined license for a [NPP] under parts 52 and 54 of this chapter, or the issuance of an initial license for storage of spent fuel at an ISFSI, or any amendment thereto (emphasis added).

In short, the environmental analysis, which is done as part of the licensing or relicensing of NPPs, as well as the initial licensing of an ISFSI, does consider the potential environmental impacts of storage of spent fuel during the term of the license. What is not considered in those proceedings — due to the generic determination in § 51.23(a) — is the potential environmental impact of storage of spent fuel for a (now) 60-year period after the end of licensed operations. Environmental analysis for this period is covered by the environmental analysis NRC has done in the Waste Confidence Decision, particularly under Findings 3, 4, and 5. This analysis enables the Commission to resolve this issue generically because it demonstrates that spent fuel will be safely stored and managed under a Part 50 or Part 72 license after the cessation of reactor operation for at least a 60-year period by which time a repository is expected to be available.

The NRC must prepare an EIS when the proposed action is a major Federal action significantly affecting the quality of the human environment or when the proposed action involves a matter that the Commission, in the exercise of its discretion, has determined should be covered by an EIS. 10 CFR 51.20(a). NRC's rulemaking action here is to incorporate a revised generic determination into § 51.23(a), which expands from at least 30 years to at least

60 years the period during which the Commission expects that spent fuel can be safely stored without significant environmental impacts after the expiration of the operating license. As the Commission explained in 1984 and 1990, this final rulemaking action formally incorporating the revised generic determination in the Commission's regulations does not have separate independent environmental impact (49 FR 34693; August 31,1984; 55 FR 38473; September 18, 1990). The environmental analysis on which the revised generic determination is based is found in the update and revisions to the Commission's Waste Confidence Decision. The update, as explained above, does not authorize any licensing or other Federal action. It does have the effect of removing from a reactor operating license proceeding or license renewal proceeding or initial ISFSI licensing proceeding the issue of whether safe storage of SNF can be accomplished without any significant environmental impact for an additional 30-year period beyond what the current generic determination provides. The update explains and documents the reasons why the Commission has reasonable assurance that this extended storage period will have no significant environmental impacts. Given this conclusion, a finding of no significant environmental impact may be made and preparation of an EIS is not warranted.

Comment 2: A number of commenters asserted that NRC, in making its Finding of No Significant Impact (FONSI), has not complied with its procedural requirements for such a finding, 10 CFR 51.32, and with the requirements of the Council on Environmental Quality (CEQ), 40 CFR 1508.13. In particular, some commenters claim that NRC has not published an environmental assessment (EA), as required by these regulations, and has not identified all the documents on which the FONSI is based. TSEP asserts that NRC's alleged failure to comply with its procedural requirements for a FONSI also results in a violation of the Administrative Procedure Act because it means the public has not had an opportunity to comment on the basis for the FONSI.

NRC Response: As explained in response to Comment 1, the only Federal action involved in this rulemaking is an expansion, by 30 years, of the Commission's Finding 4 in its Waste Confidence Decision that spent fuel generated in any reactor can be stored safely and without significant environmental impacts after the licensed life for operation of the reactor, and the incorporation of that finding into its generic determination in 10 CFR 51.23(a) concerning the temporary storage of spent fuel after cessation of reactor operations. This is the action described in NRC's proposed FONSI, *see* 73 FR 59550. The formal incorporation of revised Finding 4 into § 51.23(a) has no separate independent environmental impact from the revision of Finding 4 itself. The update and revision of the Waste Confidence Decision is itself the EA supporting the action and the basis for the FONSI and, as evidenced by the breadth of comments received, the findings of the Waste Confidence Decision have been made available for public review and comment. The update was undertaken, as a matter of discretion, to ensure the currency of the Waste Confidence findings, which had not changed in nearly 20 years.

NRC's procedural requirements for an EA call for a brief discussion of the need for the proposed action, alternatives to that action, and the environmental impacts of the proposed action and alternatives as well as a list of agencies and persons consulted and identification of the sources used. *See* 10 CFR 51.30(a). The Commission's proposal explained that the need for an update of the 1990 Waste Confidence Decision was prompted by a desire to make anticipated licensing proceedings for new reactors more efficient by laying to rest any concerns that the generic determination was out-of-date and could not be relied upon in these licensing proceedings. *See* 73 FR 59553; 59558. The Commission also explained that it did not believe that its criteria for reopening the Waste Confidence findings had been met, and it rejected a

petition for rulemaking arguing that one of the findings needed to be changed. *Id.* Thus, the Commission recognized that it could choose to take no action if it did not wish to expend the necessary resources. The Commission also explicitly raised the question, in the context of revising Finding 2, whether it should make a general finding of reasonable assurance that SNF generated in any reactor can be stored safely and without significant environmental impacts until a disposal facility can reasonably be expected to be available. *See* 73 FR 59561-59562. This would necessitate the Commission being able to similarly find, in Finding 4, that long-term storage could be undertaken indefinitely. The Commission explained what the basis of this alternative finding would be:

> In other words, in response to the court's concerns that precipitated the original Waste Confidence proceeding, the Commission could now say that there is no need to be concerned about the possibility that spent fuel may need to be stored at onsite or offsite storage facilities at the expiration of the license (including a renewed license) until such time as a repository is available because we have reasonable assurance that spent fuel can be so stored for long periods of time, safely and without significant environmental impact. Such a finding would be made on the basis of the Commission's accumulated experience of the safety of long-term spent fuel storage with no significant environmental impact (see Finding 4) and its accumulated experience of the safe management of spent fuel storage during and after the expiration of the reactor operating license (see Finding 3).

Id. The Commission explicitly sought public comment on whether any additional information would be needed to make this change. The Commission's update shows that there would be no difference between the environmental impacts of the proposed action of extending the time period for safe storage of SNF by 30 years and the no-action alternative of leaving it as it is. The Commission also recognized that the environmental impacts of the alternative of making the time period indefinite may be the same, but found no need to make such a prediction due to its expectation that a repository will be available within 50-60 years of the end of any reactor's license for the disposal of its spent fuel.

With respect to the claim that NRC must make available to the public the documents on which its FONSI relies, the commenters are correct that NRC must disclose all portions of the documents that informed its NEPA analysis and that are not exempt under the Freedom of Information Act (FOIA). The Commission acknowledged this fact when, in *Pacific Gas and Electric Co.* (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation), CLI-08-01, 67 NRC 1 (2008), it directed the NRC Staff to prepare a complete list of the documents on which it relied in preparing its EA. In the case of the Waste Confidence Decision Update, NRC has complied with this standard — all of the documents relied upon in preparing the Update and Final Rule are referenced. Two of the referenced documents are not publicly available; *i.e*., reports concerning the safety and security of spent fuel pool storage issued by Sandia National Laboratories and the National Academies (NAS), which are either Official Use Only — Security Related Information, Safeguards Information (SGI) or Classified. Although these documents cannot be released to the public, redacted or publicly available summaries are available. A redacted version of the Sandia study can be found in ADAMS at ML062290362 and the unclassified summary of the NAS report can be purchased by accessing the NAS website at: http://www.nap.edu/catalog.php?record id=11263#description, or can be read online at: http://books.nap.edu/openbook.php?record id=11263&page=R1. No other non-public documents are referenced in the Waste Confidence update.

In sum, NRC's FONSI identifies the proposed action and relies upon an environmental assessment that explains at considerable length the reasons why this action will not have a significant effect on the quality of the human environment and which describes the documents relied upon and how these documents may be accessed by the public.

Comment 3: A number of commenters asserted that NRC has failed to comply with NEPA because NRC has not prepared a GEIS to review and update Table S-3 of 10 CFR 51.51(b). Table S-3 lists environmental data to be used by applicants and the NRC staff as the basis for evaluating the environmental effects of the portions of the fuel cycle that occur before new fuel is delivered to the plant and after spent fuel is removed from the plant site for light-water reactors. Table S-3 was incorporated into NRC's rules in 1979 (*Licensing and Regulatory Policy and Procedures for Environmental Protection; Uranium Fuel Cycle Impacts from Spent Fuel Reprocessing and Radioactive Waste Management,* 44 FR 45362) ("Table S-3 Rule") and includes an assumption, based on NRC staff's analysis of disposal in a bedded-salt geologic repository, that after a repository is sealed there would be no further release of radioactive materials to the environment (the "zero release assumption"). The 1979 rulemaking also included an expectation that "a suitable bedded-salt repository site or its equivalent will be found." 44 FR 45368 (1979).

The commenters point out that NRC's proposed revisions to the Waste Confidence findings acknowledge that salt formations are now only being considered as hosts for reprocessed nuclear materials because heat-generating waste, like SNF, exacerbates a process by which salt can rapidly deform. *See* 73 FR 59555. For this and other reasons, the commenters believe that Table S-3 has been undermined and is out-of-date and needs to be reviewed in a GEIS. NRDC also believes that the Table S-3 Rule's "finding of no significant health impacts fundamentally supports the Waste Confidence Decision because its estimate of zero radioactive releases from a repository is based on the Commission's then-current Waste Confidence finding, that 'a suitable bedded-salt repository site or its equivalent will be found.'" The commenters also note that the Commission, in 1990, indicated that it would find it necessary to review the Table S-3 Rule if it found, in a future review of the Waste Confidence Decision, that

its confidence in the technical feasibility of disposal in a mined geologic repository had been lost (55 FR 38491; September 18, 1990). The commenters believe that the Commission lacks a basis for continued confidence in the technical feasibility of safe geologic disposal and that the relationship of the Table S-3 rule to the Waste Confidence Decision is such that a GEIS to review the Table S-3 Rule is a necessary prerequisite to a revision of the Waste Confidence findings.

NRC Response: The Waste Confidence Decision does not rely on findings made in the context of the Table S-3 Rule. Even in 1984, the Commission's confidence that a suitable geologic site for a repository would be found was not premised on the expectation that a bedded-salt site would be located, but rather on the fact that DOE's site exploration efforts were "providing information on site characteristics at a sufficiently large number and variety of sites and geologic media to support the expectation that one or more technically acceptable sites will be identified." (49 FR 34668; August 31, 2984). Similarly, the issue of concern to NRC in considering waste confidence has not been whether a zero-release assumption will be met, but rather when EPA would promulgate standards assuring that any releases of radioactive materials to the environment would not be inimical to public health and safety. *See* 55 FR 38500. In 1990, the Commission discussed the relationship of the Table S-3 rulemaking with the Waste Confidence findings. *See* 55 FR 38490-38491. The Commission noted that the Table S-3 proceeding was the outgrowth of efforts to address generically the NEPA requirement for an evaluation of the environmental impact of operation of a light water reactor (LWR) and that Table S-3 assigned numerical values for environmental costs resulting from uranium fuel cycle activities to support one year of LWR operation but that the Waste Confidence proceeding was not intended to make quantitative judgments about the environmental costs of waste disposal. The Commission stated that unless, "in a future review of the Waste Confidence decision, [it] finds

that it no longer has confidence in the technical feasibility of disposal in a mined geologic repository, the Commission will not consider it necessary to review the S-3 rule when it reexamines its Waste Confidence findings in the future." 55 FR 38491. The Commission continues to have confidence in the technical feasibility of disposal in a mined geologic repository (*see* NRC Response to Comment 8) so there is no need to review the S-3 rule in order to support its Waste Confidence findings. This does not preclude NRC from taking future regulatory action to amend Table S-3 if doing so appears to be necessary or desirable. In 2008, the Commission stated that "[t]he NRC will continue to evaluate, as part of its annual review of potential rulemaking activity, the need to amend Table S-3." *New England Coalition on Nuclear Pollution; Denial of Petition for Rulemaking,* 73 FR 14946, 14949 (March 20, 2008).

Comment 4: The Attorney General of California believes that the Waste Confidence Decision violates core principles of NEPA as well as NRC regulations because it does not allow for supplementation of an EIS for an ISFSI even when there is significant change in the circumstances under which a project is carried out or when there is significant new information regarding the environmental impacts of the project. *See* 10 CFR 51.92(a). He asserts that "NRC has not shown a clearly articulated justification, based on substantial evidence in the record, for the proposed extension of this presumption that no change in circumstance, and no new information, can ever trigger the NEPA duty to supplement the environmental analysis of the long-term on-site storage of nuclear waste." The Attorney General also believes that the proposed changes to the Waste Confidence Decision allow NPPs "to be substantially re-purposed and transformed into long-term storage facilities … without environmental review" and that therefore supplementation of the initial EIS for the NPP may be warranted.

NRC Response: Under 10 CFR 51.23(b), NRC need not prepare an EA or EIS which discusses the environmental impacts of spent fuel storage for the period following the term of the reactor license or initial ISFSI license because of the generic determination the Commission has made in 10 CFR 51.23(a) that spent fuel can be stored safely and without significant environmental impacts for at least 60 years beyond the licensed life of the reactor. The generic determination is based on the environmental analysis conducted in the Waste Confidence Decision. However, the commenter is not correct that this means that an EA or EIS for a reactor or an ISFSI may never need to be supplemented even if there is a significant change in circumstances or significant new information that demonstrates that application of the generic determination would not serve the purposes for which it was adopted. Under 10 CFR 51.20(a)(2), the Commission, in its discretion, may determine that a proposed action involves a matter that should be covered by an EIS. Further, 10 CFR 2.335(b) provides that a party to an adjudicatory proceeding may petition that application of the rule be waived or an exception made for the particular proceeding. The sole ground for petition for waiver or exception is that special circumstances with respect to the subject matter of the particular proceeding are such that the application of the rule would not serve the purposes for which it was adopted.

Comment 5: Riverkeeper asserts that NRC made its finding of no significant impact in its initial 1984 decision "without performing an environmental review pursuant to NEPA, explicitly stating that an [EIS] was not necessary," and then has continued to make this finding without appropriate environmental review.

NRC Response: Riverkeeper is correct that NRC concluded in 1984 that its fourth finding that SNF could be safely stored without significant environmental impacts for at least 30 years beyond the expiration of the reactor's operating license did not require the support of an EIS.

See 49 FR 34666. This hardly means, however, that this finding was made without performing an environmental review pursuant to NEPA. The Commission explained that the Waste Confidence Decision considered the environmental aspects of spent fuel storage and did comply with NEPA. *Id.* No EIS was conducted because the fourth finding provides that the environmental impacts from extended storage of SNF are so insignificant as not to require consideration in an EIS. NRC has explained in its response to Comment 1 why an EIS is unnecessary to support the expansion of its generic determination.

Issue 2: Compliance of the Waste Confidence Decision with the Atomic Energy Act (AEA)

Comment 6: Several commenters assert that the Waste Confidence Decision Update does not comply with the AEA. They point out that the AEA precludes NRC from licensing any new NPP or renewing the license of any existing NPP if it would be "inimical … to the health and safety of the public." 42 U.S.C. § 2133(d). They note that the Commission continues to state that it would not continue to license reactors if it did not have reasonable confidence that the wastes can and will in due course be disposed of safely. These commenters assert that Finding 1 effectively constitutes a licensing determination that spent fuel disposal risks are not inimical to public health and safety, and that Findings 3, 4, and 5 effectively constitute a licensing determination that spent fuel storage risks are not inimical to public health and safety. Because the commenters believe that NRC has presented no well-documented safety findings supporting its findings, they contend that NRC's revisions of its findings are in violation of the AEA.

NRC Response: As explained in response to Comment 1, NRC's revised Waste Confidence findings and revised generic determination in 10 CFR 51.23(a) are not licensing decisions. They are not determinations made as part of the licensing proceedings for NPPs or ISFSIs or

the renewal of those licenses. They do not authorize the storage of SNF in spent fuel pools or ISFSIs. The revised findings and generic determination are conclusions of the Commission's environmental analyses, under NEPA, of the foreseeable environmental impacts stemming from the storage of SNF after the end of reactor operation.

As long ago as 1978, the U.S. Court of Appeals for the Second Circuit considered the question "whether NRC, prior to granting nuclear power reactor operating licenses, is required by the public health and safety requirement of the AEA to make a determination … that high-level radioactive wastes can be *permanently* disposed of safely." *Natural Resources Defense Council v. NRC,* 582 F. 2d 166, 170 (1978) (emphasis in original). The court found that NRC was not required to make a finding under the AEA that SNF could be disposed of safely at the time a reactor license was issued, but that it was appropriate for the Commission to make this finding in considering a license application for a geologic repository. Similarly, the U.S. Court of Appeals for the District of Columbia Circuit did not vacate amendments to NPP operating licenses permitting the reracking of spent fuel storage pools because it was concerned about the availability of storage or disposal facilities at the end of licensed operation. *State of Minnesota v. NRC,* 602 F. 2d 412 (D.C. Cir. 1979). Rather, that court was concerned that the Commission's confidence on these matters had not been subjected to public scrutiny so it directed the Commission to conduct a rulemaking proceeding to assess its degree of confidence on these issues, leading to the original Waste Confidence rulemaking. The Commission will make the safety finding with respect to SNF disposal envisioned by the commenters in the context of a licensing proceeding for a geologic repository. The Commission does make the safety findings with respect to storage of SNF envisioned by the commenters in the context of licensing proceedings for NPPs and ISFSIs for the terms of those licenses. But the Commission's reasonable assurance that safe disposal of SNF can be accomplished when it is

likely to become necessary and can be safely stored after the cessation of reactor licenses is a finding made under NEPA which does not entail any violation of the AEA.

Issue 3: What is the meaning of "reasonable assurance" in the Waste Confidence findings?

Comment 7: One commenter expressed the view that NRC should continue to take a position of suspending the licensing of reactors if it does not have confidence beyond a reasonable doubt that wastes can and will be disposed of safely. Another commenter criticized NRC for "fail[ing] to define the standard for reasonable assurance — what level of assurance that they found in making their determination — 90%, 51%, 5%."

NRC Response: The "reasonable assurance" standard is not equivalent to the "beyond a reasonable doubt" standard used in the criminal law. *See North Anna Environmental Coalition v. NRC,* 533 F.2d 655, 665 (D.C. Cir. 1976) (*North Anna)*.[4] It is more akin to a "clear preponderance of the evidence" standard, and what constitutes "reasonable assurance" depends on the particular circumstances of the issue being examined. In a recent decision affirming the license renewal of the Oyster Creek NPP, the Commission explained: "Reasonable assurance is not quantified as equivalent to a 95% (or any other percent) confidence level, but is based on sound technical judgment of the particulars of a case and on compliance with our

[4] In *North Anna*, the court considered whether the Commission's "reasonable assurance" standard required an applicant for a NPP license to prove beyond a reasonable doubt that an earthquake fault under the proposed site was not capable. The court found that neither the AEA nor the pertinent regulations required the Commission to find, under its reasonable assurance standard, that the site was totally risk-free. *See also Power Reactor Development Co. v. International Union of Electrical, Radio and Machine Workers,* 367 U.S. 396, 414 (1961), where the Supreme Court rejected a claim that the Commission's finding of reasonable assurance needed to be based on "compelling reasons" when a construction permit for a reactor sited near a large population center was being considered.

regulations. . . ." *In re Amergen Energy Co.* (License Renewal for Oyster Creek Nuclear Generating Station)*, CLI-09-07, _NRC_ (April 1, 2009).* Thus, the Commission's reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely without significant environmental impacts for at least 60 years beyond the licensed life for operation of that reactor is based on a clear preponderance of the technical and scientific evidence described in the discussion of Finding 4. The Commission's reasonable assurance that sufficient repository capacity will be available within 50-60 years beyond the licensed life of a reactor is somewhat different in that it necessarily includes predictions as to how long it may take to resolve the institutional issues related to a repository, such as securing political and societal acceptance of a repository. Such predictions are not scientific, and thus the evidence used to make them has more qualitative content than evidence considered for strictly scientific or technical issues.

Issue 4: Whether the Commission has an adequate basis for reaffirming Finding 1

Comment 8: TSEP believes that the Commission lacks a sound basis for reaffirming Finding 1: that there is reasonable assurance that safe disposal of HLW and SNF in a mined geologic repository is technically feasible. In support of its view, TSEP provides comments of the Institute for Energy and Environmental Research (IEER), authored by Dr. Arjun Makhijani. IEER states that "the Waste Confidence Decision presents a safety finding, under the Atomic Energy Act, that the NRC has reasonable assurance that disposal of spent fuel will not pose an undue risk to public health and safety. It does so via the finding that disposal is technically feasible and can be done in conformity with the assumption of zero releases in Table S-3 …." IEER believes that NRC has failed to address available information which shows that the NRC

currently does not have an adequate technical basis for a reasonable level of confidence that spent fuel can be isolated in a geologic repository.

IEER defines "safe disposal" as involving "(i) the safety of building the repository, putting the waste in it, and backfilling and sealing it, and (ii) the performance relative to health and environmental protection standards for a long period after the repository is sealed…. [I]t is essential to show a reasonable basis for confidence that the public and the environment far into the future will be adequately protected from the effects of disposal at a specific site and a specific engineered system built there." Further, IEER believes that "reasonable assurance" requires "a statistically valid argument based on real-world data that would show (i) that all the elements for a repository exist and (ii) that they would work together as designed, as estimated by validated models. The evidence must be sufficient to provide a reasonable basis to conclude that the durability of the isolation arrangements would be sufficient to meet health and environmental standards for long periods of time … with a high probability." IEER believes that NRC does not have the requisite reasonable assurance because NRC "has not taken into account a mountain of data and analysis" derived from the Yucca Mountain repository program and from the French program at the Bure site, which illustrate the problems these programs have encountered and thus show, in IEER's view, "that it is far from assured that safe disposal of spent fuel in a geologic repository is technically feasible." IEER also cites the historical difficulty the Environmental Protection Agency (EPA) has had in formulating radiation protection standards and notes that "[w]ithout a final standard that is clear of court challenges, performance assessment must necessarily rest on guesses about what it might be; this is not a basis on which 'reasonable assurance' of the technical feasibility of 'safe disposal' can be given, for the simple reason that there is no accepted definition of safe in relation to Yucca Mountain as yet."

NRC Response: IEER confuses the safety finding that NRC must make under the Atomic Energy Act when considering an application for a license to construct and operate a repository at an actual site with the Waste Confidence findings made under NEPA, including the finding that there is reasonable assurance that safe disposal of HLW and SNF is technically feasible. *See* response to Comment 6. The NRC is currently reviewing DOE's application for a construction authorization at the Yucca Mountain site and will consider information submitted with admitted contentions which may call into question DOE's ability to safely dispose of HLW and SNF at that site. However, it is very important that the Commission preserve its adjudicatory impartiality and not consider *ex parte* communications of the type proffered by IEER outside of the Yucca Mountain licensing proceeding, and it has been careful not to do so in the context of reviewing its Waste Confidence findings. *See* 10 CFR 2.347.

Webster's Third New International Dictionary (1993) defines "feasible" as "capable of being done, executed, or effected: possible of realization." The Commission began its discussion of Finding 1 in its original 1984 decision by stating that "[t]he Commission finds that safe disposal of [HLW and SNF] is technically *possible* and that it is achievable using *existing* technology." 49 FR 34667 (emphasis added). The Commission then went on to say: "Although a repository has not yet been constructed and its safety and environmental acceptability demonstrated, no fundamental breakthrough in science or technology is needed to implement a successful waste disposal program." *Id.* This focus on whether a fundamental breakthrough in science or technology is needed has guided the Commission's consideration of the feasibility of the disposal of HLW and SNF.

The Commission identified three key technical problems that would need to be solved: the selection of a suitable geologic setting, the development of waste packages that can contain the waste until the fission product hazard is greatly reduced, and engineered barriers that can effectively retard migration of radionuclides out of the repository. *Id.* In 1984, the Commission reviewed evidence indicating that there are geologic media in the United States in many locations potentially suitable for a waste repository; that the chemical and physical properties of HLW and SNF can be sufficiently understood to permit the design of a suitable waste package; and that DOE's development work on backfill materials and sealants provided a reasonable basis to expect that backfill materials and long-term seals can be developed. In 1990, the Commission noted that the NRC staff had not identified any fundamental technical flaw or disqualifying factor for any of the 9 sites DOE had identified as potentially acceptable for a repository, even though the HLW program was then focused exclusively on the Yucca Mountain site. *See* 55 FR 38486. Similarly, the Commission found no reason to abandon its confidence in the technical feasibility of developing a suitable waste package and engineered barriers, even though DOE's scientific programs were focused on Yucca Mountain. *See* 55 FR 38488-38490. Both EPA and NRC have standards in place that would have to be met by either the proposed repository at Yucca Mountain or a repository at any other site. *See* 40 CFR Parts 190 and 197 and 10 CFR Parts 60 and 63.

IEER does not assert that the need for a scientific or technical breakthrough stands in the way of establishing any possible repository; rather, IEER believes that the evidence it has offered shows that a repository at Yucca Mountain will not be capable of meeting EPA's standards and NRC's performance objectives. This could turn out to be the case, but this does not cause the Commission to believe that safe disposal of HLW and SNF in some repository is not possible.

Issue 5: Whether the Commission has an adequate basis to revise Finding 2

Comment 9: Many commenters responded to the Commission's request for comments on whether the Commission should revise Finding 2 to predict that repository capacity will be available within 50-60 years beyond the licensed life for operation of all reactors or whether the Commission should adopt a more general finding of reasonable assurance that SNF generated in any reactor can be stored safely and without significant environmental impacts until a disposal facility can reasonably be expected to be available.

Specific Question for Public Comment: In its proposed rule and its proposed revisions to the Waste Confidence Decision, the Commission explicitly requested public comment on an alternative approach to Finding 2. *See* 73 FR 59550; 73 FR 59561. The Commission recognized that its proposed revision of Finding 2 to include a timeframe for availability of repository capacity within 50-60 years beyond the licensed life for operation of all reactors is based on its assessment not only of its understanding of the technical issues involved, but also predictions of the time needed to bring about the necessary societal and political acceptance for a repository site. Recognizing the inherent difficulties in making such predictions, the Commission outlined an alternative approach wherein it would adopt a more general finding of reasonable assurance that SNF generated in any reactor can be stored safely and without significant environmental impacts until a disposal facility can reasonably be expected to be available. Such a finding would be made on the basis of the Commission's accumulated experience of the safety of long-term spent fuel storage with no significant environmental impact (see Finding 4) and its accumulated experience of the safe management and storage of spent fuel during and after the expiration of the reactor operating license (see Finding 3). The

Commission also asked whether additional information is needed for such an approach or whether accompanying changes should be made to its other Findings on the long-term storage of spent fuel if this approach is adopted.

The State of Nevada (NV), Clark and Eureka Counties in NV, and the Nuclear Energy Institute (NEI) provided comments supporting the alternative approach to Finding 2. NV supports the approach because it believes that specifying a timeframe involves too much speculation about public acceptance, future technology, a possible redirection of the waste disposal program, adequate funding, and the outcome of NRC licensing proceedings. NV believes that "whatever the NRC's period of safe storage might be, it is long enough for the Commission to generally conclude that, even if Yucca Mountain fails, one or more other repository sites (or some other form of disposition) would be available before dry storage of reactor spent fuel … could pose any significant safety or environmental problem." Further, NV suggested that if the Commission followed this approach, it could dispense with Finding 2 altogether since Finding 3 provides reasonable assurance that HLW and SNF will be managed in a safe manner until sufficient repository capacity is available. Clark and Eureka Counties believe that focusing waste confidence on management of SNF allows for consideration of a more systemic approach to waste management that considers an array of options and takes into account evolving energy policy at the national and international level, technology enhancements, and scientific research that could lead to new approaches and alternatives. NEI states that "identifying the exact number of years involved is not necessary because, for whatever length of time is needed, the NRC's regulations will continue to provide a high standard of safety in the storage of spent nuclear fuel, and industry is compelled to comply with these regulations."

Many comments from States, State organizations, one NV county, environmental groups and individuals opposed the alternative approach and want the Commission to retain a timeframe. One theme of these commenters is that a timeframe is necessary to provide an incentive to the Federal Government to meet its responsibilities for the disposal of HLW. One commenter favored only a slight extension of the repository availability date to 2035 in the belief that a further extension or removal of a timeframe would remove virtually all societal incentives for the United States to develop a geologic repository. Some commenters feared that removal of a timeframe, which would remove any pressure on the federal government to resolve the SNF disposal issue, would lead to added costs to taxpayers due to the accumulating damages incurred by DOE because of its failure to honor its contracts for accepting SNF. Nye County, NV believes that removal of the timeframe implies that there is no urgency in implementing NWPA. Nye County believes that waste confidence would better be achieved if Finding 2 included a reaffirmation of the need for a repository for ultimate waste confidence and for its role in the nation's commitment to support the environmental cleanup of weapons program sites because a repository will be needed even if other options for spent fuel management, such as recycling, are adopted.

Some commenters believe that removal of a timeframe does not pay attention to intergenerational ethical concerns of this generation reaping the benefits of nuclear energy, while just passing off the nuclear waste products to future generations without providing them any ultimate disposal solution. Nye County believes that intergenerational equity is still the primary international basis for the policy of geologic disposal. The Western Interstate Energy Board, in urging retention of a timeframe, states that NRC should be concerned about the possibility of indefinite storage of SNF because it undermines support for a plan for disposal of

nuclear waste, noting that approval of a new generation of NPPs should be contingent on a credible plan by which the Federal Government meets its responsibilities.

The Attorneys General of New York, Vermont, and Massachusetts believe that "NRC has admitted that its original thirty-year time estimation was based on no scientific or technical facts, but instead on the period of time in which it expected a repository to be available. …. The NRC's reasoning — that because no problems significant in NRC's eyes have [yet] occurred …, no problems will occur no matter how long spent fuel remains on reactor sites — is antithetical to science, the laws of time, and common sense. For example, over an indefinite period of storage, the probability of a severe earthquake increases." They believe NRC's alternative approach is arbitrary because they believe there is no basis for such unconditional confidence in the indefinite on-site or off-site storage of waste. Similarly, another commenter asserted that the premise is questionable that storage of SNF at current sites for 150 years or more "is safe and feasible merely on the basis of the much more limited experience involving SNF storage to date, particularly at ISFSIs, and at fewer locations with lower quantities of SNF, compared to what would exist over such a long time span."

In addition, the Attorneys General believe that in proposing to revise the generic determination in 10 CFR 51.23(a) without reference to any timeframe, NRC has prematurely and inappropriately adopted the alternative approach without waiting for public comments. Similarly, the Prairie Island Indian Community believes that, in the absence of a timeframe, "the Waste Confidence Rule would be premised on the pure speculation that a disposal facility will be available at some unknown point in the future." NRDC believes that NRC's alternative approach "is contrary to the NRC's long-standing policy of [having] at least some minimal time limitation on the actions of its licensees with respect to active institutional controls at nuclear

facilities," *e.g.*, 10 CFR 61.59(b), which prohibits reliance on institutional controls for more than 100 years by the land owner or custodial agency of a low-level waste disposal site.

NRC Response: In 1990, the Commission explained that it had not identified a date by which health and safety reasons require that a repository must be available. *See* 55 FR 38504. The Commission noted that in 1984 it had found, under Finding 3, that SNF would be safely managed until sufficient repository capacity is available but that safe management would not need to continue for more than 30 years beyond the expiration of any reactor's operating license because sufficient repository capacity was expected to become available within those 30 years. The Commission also had reached the conclusion, under Finding 4, that SNF could be safely stored for at least 30 years beyond the expiration of the operating license. *Id.* In 1990, the Commission included a license renewal term of 30 years within Finding 2[5] and explained its reasons for believing that "there is ample technical basis for confidence that spent fuel can be stored safely and without significant environmental impact at these reactors for at least 100 years." 55 FR 38506. Thus, it is not correct to say that "NRC has admitted that its original thirty-year time estimation was based on no scientific or technical facts." Rather, NRC's time estimation was based on both the time it expected a repository to be available and all the scientific and technical facts it discussed under Findings 3 and 4 supporting a conclusion that SNF could be safely managed and stored for at least that period of time. In fact, the Commission considered a comment urging that the Commission find that SNF can be stored safely in dry storage casks for 100 years. *See* 55 FR 38482. The Commission did not "dispute a conclusion that dry spent fuel storage is safe and environmentally acceptable for a period of

[5] The license renewal period for operating reactors subsequently provided for in 10 CFR Part 54 is set at 20 years.

100 years," but rejected this suggestion because it found that safe storage without significant environmental impact could take place for "at least" 30 years beyond the licensed life for operation of the reactor, and because it supported "timely disposal of [SNF and HLW] in a geologic repository, and by this Decision does not intend to support storage of spent fuel for an indefinitely long period." *Id.*

The fact that the Commission, in 1990 and now, has confidence that SNF can be safely stored for long periods of time does not mean, however, that the Commission has examined scientific and technological evidence supporting *indefinite* storage. The commenters supporting alternative Finding 2 did not provide such evidence. The State of Nevada, in its 2005 petition for rulemaking, requested, *inter alia,* that NRC define "availability" by presuming that some acceptable disposal site would be available at some undefined time in the future. In denying the petition, the Commission said "[w]e find this approach inconsistent with that taken in the 1984 [WCD] because it provides neither the basis for assessing the degree of assurance that radioactive waste can be disposed of safely nor the basis for determining when such disposal will be available." 70 FR 48333 (2005). As explained in response to Comment 1, NRC's action in this update of the 1990 WCD is to expand its generic determination in 10 CFR 51.23(a) by 30 years, an action we have found to result in no significant environmental impacts and therefore not to require an EIS. The Commission's approach in proposed Finding 2 acknowledges the need for permanent disposal, and for the generations that benefit from nuclear energy to bear the responsibility for providing an ultimate disposal for the resulting waste. The Commission believes that it would be more prudent to allow for the accumulation of further evidence and experience before taking an action which would replace a timeframe with indefinite storage. As the Commission stated in its proposed "target date approach" for Finding 2 which estimates repository availability within 50-60 years of the licensed life for operation of any reactor:

> [T]his approach would make it more clear that specification of a particular time for when a repository could be built does not imply that radioactive waste would pose unsafe conditions if a repository were not available at that time. The capability to safely store radioactive waste over long periods is a viable interim alternative not dependent on any one specific year for availability of a repository.

73 FR 59558.

As the Attorneys General, as well as other commenters, noted, the proposed rule was phrased differently from the proposed revision of Finding 2 in that the proposed rule made a generic determination of safe storage of SNF "until a disposal facility can reasonably be expected to be available" whereas Finding 2 made a prediction of repository availability "within 50-60 years beyond the licensed life for operation" which led, in Finding 4, to a finding of reasonable assurance of safe storage of SNF "for at least 60 years beyond the licensed life for operation." NRC's phrasing was only intended to simplify the rule and not to prematurely adopt alternative Finding 2. The basis for the rule is identical to the basis for the findings, no matter how the rule itself is phrased. However, the Commission has reconsidered the phrasing of the proposed rule, and the final rule now limits the generic determination to "at least 60 years beyond the licensed life for operation (which may include the term of a revised or renewed license)." Section 51.23(a) is also revised to reinsert a version of the second sentence in the present rule that was excluded from the proposed rule. This statement was added to make clear that Finding 4 does not contemplate indefinite storage and to underscore the fact that the 60 year storage period is related to the Commission's expectation that repository capacity will be available within 50-60 years of the licensed life for the operation of any reactor. Accordingly, the added sentence provides that there is "reasonable assurance that sufficient mined geologic repository capacity will be available within 50-60 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of any reactor to dispose of the

commercial high-level waste and spent fuel originating in such reactor and generated up to that time."

Comment 10: TSEP claims that the survey of various country HLW disposal programs NRC provided to review the issue of social and political acceptability of a repository itself shows that there can be no confidence that the necessary social and political conditions exist in the United States to provide any assurance that a repository can be developed in any foreseeable timeframe. TSEP also believes that NRC's survey is inaccurate and essentially incomplete in that it omits the country that is often held up as being exemplary for nuclear power — France.

NRC Response: The NRC rejects the commenter's assertion that NRC's examination of international experience itself shows that there can be no confidence that a repository will be developed in the United States in any foreseeable timeframe. NRC's delineation of the HLW programs of other countries was intended to show that those countries have programmed into their plans various methodologies for securing social and political acceptance of a repository. This has been a trial and error process which has led to both failures and successes. The processes, especially in Finland and Sweden, show that this focus on deliberate attempts to gain public support can lead to success given a sufficiently inclusive process and enough time.

The commenter believes NRC's survey is partly inaccurate because NRC incorrectly implies that the United Kingdom (UK) ended a program for developing a repository for HLW and SNF in 1997 when, in fact, the program cited was for disposal of intermediate-level waste (ILW). The NRC agrees with the commenter that one sentence describing the UK program is misleading. This is because of a typographical error where "HLW" was inserted mistakenly instead of "ILW". This error is corrected in the final update.

With respect to the omission of France, NRC did not seek to provide an exhaustive survey or complete history of all foreign repository programs. The NRC examined a number of international examples for the purpose of reasonably estimating the minimum time needed to "develop … societal and political acceptance in concert with essential technical, safety and security assurances." The NRC noted that France was among ten nations that have established target dates (France expects that its repository will commence operation in 2025) and among seven nations, of those ten, that plan disposal of reprocessed SNF/HLW. *See* 73 FR 59558. A brief examination of the progress of France's waste disposal program suggests a timeframe that is consistent with a range of 25-35 years for achieving societal and political acceptability of a repository. Initial efforts in France in the 1980s failed to identify potential repository sites using solely technical criteria. Failure of these attempts led to the passage of nuclear waste legislation that prescribed a period of 15 years of research. Reports on generic disposal options in clay and granite media were prepared and reviewed by the safety authorities in 2005. In 2006, conclusions from the public debate on disposal options, held in 2005, were published. Later that year, the French Parliament passed new legislation designating a single site for deep geologic disposal of intermediate and HLW. This facility, to be located in the Bure region of northeastern France, is scheduled to open in 2025, some 34 years after passage of the original Nuclear Waste Law of 1991.

Comment 11: Several commenters believe that the history of the U.S. repository program demonstrates that there should be no assurance that the political and social acceptance needed to support development of a repository in the timeframe envisioned in Finding 2 will be realized.

NRC Response: The Commission acknowledges the difficulties that the U.S. HLW program has encountered over the years from the failed attempt to locate a repository in a salt mine in Lyons, Kansas, through the strong and continuous opposition to the proposed repository at Yucca Mountain. Nevertheless, the commenters overlook a number of key developments that support the Commission's confidence that a repository will be available within 50-60 years beyond the licensed life for operation of any reactor.

First, the comments assume that any repository program must start over from the beginning. But any new repository program would build upon the lessons learned from the Yucca Mountain and other repository programs. Other countries are working toward development of a repository, and some have settled upon a process that is designed to deal with many of the societal and political issues that have delayed the U.S. program. *See* Finding 2 *infra.*

Second, Congress and DOE are planning some form of expert panel to evaluate the current direction of the HLW and SNF disposal program. Specifically, the Senate is considering a bill to appoint a National Commission on High-Level Radioactive Waste and Spent Nuclear Fuel. National Commission on High-Level Radioactive Waste and Spent Nuclear Fuel Establishment Act of 2009, S. 591, 111th Congress (1st Sess. 2009). DOE is also considering the appointment of a similar panel. "Obama budget seeks end to Yucca nuclear waste dump," http://www.reuters.com/article/idUSTRE5464TM20090507, (last visited June 1, 2009). However a panel is formed, whether by Congress or DOE, three scenarios are likely to be included: 1) disposal of HLW and SNF at a new repository; 2) a domestic reprocessing program with the resulting HLW disposed at a new repository; and 3) long-term onsite storage of SNF and HLW before development of a repository. The NWPA still mandates a national repository program, and decades of scientific studies support the use of a repository for disposal of HLW and SNF.

Unless the law is changed, disposal in a repository remains the controlling policy. But if the panel were to recommend option 3, or some other option that does not involve disposal of waste in a repository within the timeframe envisioned in Finding 2, and Congress were to enact such a recommendation into law, NRC would likely have to revisit the Waste Confidence findings. Finding 2 is not a finding that sufficient repository capacity must be available within 50-60 years of the licensed life of a reactor for public health or safety reasons; it is a prediction that a repository will be available in this period of time.

Finally, the Commission reiterates Finding 1, which states that the Commission finds reasonable assurance that safe disposal of HLW and SNF in a mined geologic repository is technically feasible. This finding has remained unchanged since 1984. The more difficult problem challenging a repository program is achieving political and social acceptance, but this problem can be solved. By applying the lessons learned in the Yucca Mountain program and in the different methodologies for achieving acceptance used in international HLW programs, the Commission remains confident that the institutional issues impeding the construction of a repository can be resolved within 50-60 years beyond the licensed life for operation of any reactor.

Comment 12: One commenter worried that “a decision in favor of this proposed rule change could prejudice a licensing decision in favor of the Yucca Mountain project simply because it would announce confidence in a waste site and that is the only one there.” The commenter also fears that this rulemaking could bias a decision to lift or eliminate the statutory capacity limit on Yucca Mountain which would be necessary for this repository to accept SNF from new reactors. Further, the commenter believes that if the Yucca Mountain project fails, there will be no basis for confidence that a waste site will be available in the future.

NRC Response: The Commission's reaffirmation of Finding 1 that disposal of HLW and SNF is technically feasible and its revision of Finding 2, which states confidence that repository capacity will be available within 50-60 years of the end of licensed operation of any reactor, are not tied to any particular site. In fact, the Commission's proposal assumed that Yucca Mountain would not go forward and become available as a repository. Moreover, the Waste Confidence Decision and rule have no legal effect in the Yucca Mountain licensing proceeding. See *Nevada v. NRC,* No. 05-1350 (D.C. Cir, Sept. 22, 2006). Therefore, NRC does not believe that adopting these findings will prejudice a licensing decision in favor of Yucca Mountain. DOE expects that by 2010 SNF will exceed the 70,000 MTHM statutory limit, and that if all existing reactors continue to operate for a total of 60 years through license renewals, SNF will exceed 130,000 MTHM. *See The Report to the President and the Congress by the Secretary of Energy on the Need for a Second Repository,* DOE/RW-0595, December, 2008. Thus, the amount of SNF from current reactors alone would require a change in the statutory limit or a second repository. Finally, as stated above, the proposed revision of Finding 2 assumed that Yucca Mountain would not go forward. NRC's basis for continued confidence that a repository will be available in the future is explained in its response to Comment 11, *supra*.

Comment 13: The State of Nevada favored the Commission's alternative approach to Finding 2, but also suggested that 10 CFR 51.23(a) be reworded as follows:

> The Commission has made a generic determination that there is reasonable assurance all licensed reactor spent fuel will be removed from storage sites to some acceptable disposal site well before storage causes any significant safety or environmental impacts. This generic finding does not apply to a reactor or storage site if the Commission has found, in the 10 CFR Part 50, Part 52, Part 54 or Part 72 specific licensing proceeding, that storage of spent fuel during the term requested in the license application will cause significant safety or environmental impacts.

Nevada explains that the last sentence is added to be consistent with 10 CFR 51.23(c), which provides that § 51.23(a) does not alter any requirement to consider environmental impacts during the requested license terms in specific reactor or spent fuel storage license cases. Nevada states that "NRC should not prejudge this review of potential safety or environmental impacts from storage during the requested license term in any pending or future licensing proceeding. Nevada also states that in the event the Commission adopts Finding 2 as proposed, "it needs to clear up the ambiguity inherent in the reference to the 50-60 year time period. Presumably the Commission means it expects a repository within 60 years."

NRC Response: For the reasons explained in response to Comment 9, the Commission has decided to go forward with Finding 2 as proposed. 10 CFR 51.23(c) points out that the generic determination in 10 CFR 51.23(a) only applies to the period following the term of the reactor operating license or amendment, reactor combined license or amendment, or initial ISFSI license or amendment in proceedings held under 10 CFR Parts 50, 52, 54 and 72. Nevada is concerned that in a case where the environmental impacts during the term of the license were judged to be significant, there would be reason to doubt the applicability of a generic determination that the impacts occurring after the requested license term would not be significant and so has proposed inclusion of a second sentence in 10 CFR 51.23(a). But the Commission already has a rule, 10 CFR 2.335, that allows a party to an adjudicatory proceeding to seek a waiver or exception to a rule where its application would not serve the purposes for which the rule was adopted. Thus, the Commission declines to adopt this additional sentence. In proposing its target date approach to Finding 2, the Commission noted that this approach "would make it more clear that specification of a particular time for when a repository could be built does not imply that radioactive waste would pose unsafe conditions if a repository were not

available at that time. The capability to safely store radioactive waste over long periods is … not dependent on any one specific year for availability of a repository." 73 FR 59558. Phrasing the generic determination in terms of a range of years rather than a single year serves to highlight the fact that the prediction of storage of SNF for 50-60 years after licensed operation is not a safety determination but only an estimation of the likely availability of a repository.

Issue 6: Whether the Commission has an adequate basis to reaffirm Finding 3

Comment 14: One commenter stated that NRC appears to ignore the reality that available legal and corporate strategies exist that can provide for the transfer of NPPs and ISFSIs, and the SNF itself, to unfunded separate limited liability companies that can easily abandon SNF at existing sites once the economic value of the generating plants is exhausted.

NRC Response: The transfer of a license for a NPP is governed by 10 CFR 50.80. An applicant for transfer of its license must provide the same information on financial and technical qualifications for the proposed transferee as is required for the initial license. Therefore, the entity intended to receive the license must demonstrate its ability to meet the financial obligations of the license. Both general and specifically licensed ISFSIs are required to demonstrate financial qualifications in order to be issued a license. The requirements for general licensees are in 10 CFR Part 50, while the financial qualifications for specifically licensed ISFSIs are in 10 CFR Part 72.

A general license is issued to store spent fuel at an ISFSI "[a]t power reactor sites to persons authorized to possess or operate nuclear power reactors under 10 CFR part 50 or 10 CFR part 52." 10 CFR 72.210. Under 10 CFR 50.54(bb), NPP licensees must have a

program to manage and provide funding for the management of spent fuel following permanent cessation of operations until title to and possession of the fuel is transferred to the Secretary of Energy. As required in 10 CFR 72.30(c), all general licensees must provide financial assurance for sufficient funds to decommission the ISFSI. In addition, general licensees who have decommissioned their site, with the exception of the ISFSI and support facilities, must demonstrate that they have sufficient funds to decommission the ISFSI after the spent fuel is permanently transported offsite.

Applicants for a specific license to store spent fuel pursuant to 10 CFR Part 72 are required to demonstrate their financial qualifications. *See* 10 CFR 72.22(e). To meet the financial requirements, the applicant must show that it either possesses the necessary funds or has reasonable assurance of obtaining the necessary funds to cover ISFSI construction, operating, and decommissioning costs. In addition, a specific licensee that wants to transfer its license must submit an application that demonstrates the same financial qualifications of the proposed transferee as are required by the initial license. *See* 10 CFR 72.50. Most specific licensees are financially backed by a utility with either an operating or shutdown NPP and are required under 10 CFR 50.54(bb) to have sufficient resources for spent fuel management after cessation of operations. Other specific licensees, not located at a NPP site, that are currently storing spent fuel are backed either by a large corporation, such as General Electric (the GE Morris ISFSI), or by the Department of Energy, in the case of the Three Mile Island, Unit 2, and Ft. Saint Vrain ISFSIs.

Issue 7: Whether the Commission has an adequate basis for finding that SNF generated in any reactor can be stored safely and securely and without significant environmental impact for at least 60 years.

Comment 15: Several commenters posited that NRC does not have an adequate technical basis for finding reasonable assurance that SNF can be stored safely and without significant environmental impact because they believe that high-density spent fuel storage pools (SFPs) are vulnerable to catastrophic fires that may be caused by accidents or intentional attacks. These commenters do not believe that NRC has properly assessed this risk. TSEP submitted a report, entitled "Environmental Impacts of Storing Spent Nuclear Fuel and High-Level Waste from Commercial Nuclear Reactors: A Critique of NRC's Waste Confidence Decision and Environmental Impact Determination," prepared by Dr. Gordon R. Thompson, the Executive Director of the Institute for Resource and Security Studies ("Thompson Report"), which describes potential risks associated with a fire in a SFP following a loss of water from the pool. The Thompson Report takes the view that the NRC documents published on the risk of pool fires are inadequate and objects to the fact that some of the more recent documents rely on "secret studies" which cannot be verified by the public. The Attorney General of California requests that NRC reconsider the information on the risks of SFP fires that California and Massachusetts submitted with their rulemaking petitions which NRC denied. *See The Attorney General of Commonwealth of Massachusetts, The Attorney General of California; Denial of Petitions for Rulemaking,* 73 FR 46204 (August 8, 2008) (MA/CA Petition).

Dr. Thompson also questioned the analyses and assumptions that support the Staff's conclusions regarding terrorist attacks on ISFSIs. Dr. Thompson defined four types of potential attack scenarios and noted that the Staff's previous analyses, specifically the Diablo Canyon EA, focus only on Type III scenarios and ignore the far less dramatic, but far more effective, Type IV releases. Thompson Report at 47-48. Type I releases are those caused by the vaporization of the ISFSI by a nuclear explosion and are not considered by Dr. Thompson in his

analysis. Thompson Report at Table 7-8. Type II releases deal with an attack by aerial bombing, artillery, rockets, etc., resulting in rupture of the ISFSI and large dispersal of the contents of the cask. *Id.* Type III events are similar to Type II, but involve small dispersal of the contents of the cask, and are caused by vehicle bombs, impact by commercial aircraft, or perforation by a shaped charge. *Id.* Finally, Type IV events are caused by missiles with tandem warheads, close-up use of shaped charges and incendiary devices, or removal of the overpack lid. *Id.* This type of attack results in scattering and plume formation similar to that of a Type III event, but the release of material far exceeds that of a Type III event. *Id.* Dr. Thompson claims that the Staff's analysis does not consider the environmental impacts of a Type IV attack on an ISFSI. *Id.* at 48.

NRC Response: NRC's 1990 Waste Confidence Decision described the studies the NRC Staff had undertaken prior to that time of the catastrophic loss of reactor SFP water possibly resulting in a fuel fire in a dry pool. *See* 55 FR 38511 (1990). The proposed update further details the considerable work NRC has done in evaluating the safety of SFP storage, including the scenario of a SFP fire, and notes that following the terrorist attacks of September 11, 2001, NRC undertook a complete reexamination of SFP safety and security issues. *See* 73 FR 59564-59565.[6] The proposed update cites, in particular, the Commission's careful consideration of this issue in responding to the MA/CA Petition. That petition asserted that spent fuel stored in high-density SFPs is more vulnerable to a zirconium fire than NRC had concluded in the GEIS for renewal of NPP licenses. The petitioner raised the possibility of a successful terrorist attack as increasing the probability of a SFP zirconium fire. The petition

[6] NRC's reexamination of safety and security issues included consideration of reports issued by Sandia National Laboratories and the National Academy of Sciences, which are official-use-only security-related information, safeguards information (SGI) or classified, and thus cannot be released to the public, But public versions of these reports are available. *See* response to comment 2 *supra*.

proffered "new and significant information" on this issue, including a study by Dr. Thompson, *see Risks and Risk-Reducing Options Associated with Pool Storage of Spent Nuclear Fuel at the Pilgrim and Vermont Yankee Nuclear Power Plants,* May 25, 2006 (Thompson 2006 Report), and a report by the National Academies Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage, *see Safety and Security of Commercial Spent Nuclear Fuel Storage* (National Academies Press: 2006) (NAS Report). The Commission considered all of this information but concluded that "[g]iven the physical robustness of SFPs, the physical security measures, and SFP mitigation measures, and based upon NRC site evaluations of every SFP in the United States … the risk of an SFP zirconium fire, whether caused by an accident or a terrorist attack, is very low." 73 FR 46208 (2008).

The commenters are dissatisfied with NRC's analysis of this issue, but the only new information they have provided is Dr. Thompson's 2009 Report. The NRC has reviewed the 2009 Report but has found no information not previously considered by NRC. The Attorney General of California contends that NRC should have considered the information supplied by the petitioners with the MA/CA Petition. The NRC did consider this information but explained that the information was neither new nor significant and would not lead to an environmental impact finding different from that set forth in the GEIS for license renewal. Dr. Thompson's contention that the NRC did not consider credible threats to ISFSIs that would cause significant environmental impacts has already been addressed by the Commission in *Pacific Gas and Electric Co.* (Diablo Canyon Independent Spent Fuel Storage Installation), 67 NRC 1, CLI-08-01 (2008). In that case, the San Luis Obispo Mothers for Peace submitted an affidavit and report by Dr. Thompson, which argued that the NRC staff should have considered, but failed, to consider, "scenarios with much larger releases of radiation [that] are also plausible and should have been considered. . . . [for] example [a scenario] . . . where the penetrating device is accompanied by

an incendiary component that ignites the zirconium cladding of the spent fuel inside the storage cask, causing a much larger release of radioactive material than posited in scenarios where the cases sustain minimal damage." *Id.* at 19. But the Commission considered this argument and found that "[a]djudicating alternate terrorist scenarios is impracticable. The range of conceivable (albeit highly unlikely) terrorist scenarios is essentially limitless, confined only by the limits of human ingenuity." *Id.* at 20. Further, the Commission found that the Staff's approach to its terrorism analysis, "grounded in the NRC Staff's access to classified threat assessment information, is reasonable on its face." *Id.* In his comment, Dr. Thompson attempts to revisit the Diablo Canyon proceeding by claiming that "the Staff limited its examination to Type III releases." Thompson Report at 48. Not only has this issue already been addressed by the Commission, but some of the specifics of Dr. Thompson's "Type IV" releases are discussed and dismissed by the Commission. Thompson Report Table 7-8; *Diablo Canyon* at 19-20.

Comment 16: A number of commenters urged the Commission to consider the increasing frequency of spent fuel pool leaks as evidence calling into question NRC's confidence in the safety of SNF storage in the normal operation of spent fuel pools. Comments submitted by the Attorneys General of the States of New York and Vermont and the Commonwealth of Massachusetts described leaks of tritium at reactor sites around the country. They believe that increased on-site storage increases the opportunity for human error resulting in unauthorized releases. They are concerned about the lack of monitoring requirements or guidelines for these spent fuel leaks.

NRC Response: NRC's proposed revision and update of the Waste Confidence Decision acknowledged incidents of groundwater contamination originating from spent fuel pool leakage. The Liquid Radioactive Releases Lessons Learned Task Force, created in response to these

incidents, reported that near-term health impacts resulting from the leaking spent fuel pools investigated were negligible but also suggested 26 specific recommendations for improvements to NRC's regulatory programs regarding unplanned radioactive liquid releases. *See* Report Nos. 05000003/2007010 and 05000247/2007010, May 13, 2008 (ML0813404250), as well as "Liquid Release Task Force Recommendations Implementation Status as of February 26, 2008," (ML07320982). In response, NRC has published a proposed rule seeking to amend 10 CFR Part 20 to specifically require licensees to conduct their operations to minimize the introduction of residual activity into the site, including subsurface soil and groundwater. *See* 73 FR 3812; January 22, 2008. The NRC has also revised several guidance documents as well as an Inspection Procedure to address issues associated with leaking spent fuel pools. The NRC will continue to follow this issue and NRC regulatory oversight will continue to ensure safety and appropriate environmental protection. Thus, the Commission remains confident that storage of SNF in pools will not have any significant environmental impacts.

Comment 17: A number of commenters express the view that NRC's revisions of its Waste Confidence Decision and temporary storage rule do not comply with the holding of the Ninth Circuit Court of Appeals in *San Luis Obispo Mothers for Peace v. NRC*, 449 F. 3d 1016 (9th Cir. 2006), *cert. denied,* 127 S. Ct. 1124 (2007), that environmental analysis under NEPA requires an examination of the environmental impacts that would result from an act of terrorism against an ISFSI because such an attack is reasonably foreseeable and not remote and speculative as NRC had argued.

NRC Response: The NRC acknowledges that one issue impacting Finding 4 is the potential risks of accidents and acts of sabotage at spent fuel storage facilities. In 1984 and 1990, NRC provided some discussion of the reasons why it believed that the possibility of a major accident

or sabotage with offsite radiological impacts at a spent fuel storage facility was extremely remote. In the proposed Update, the Commission gave considerable attention to the issue of terrorism and spent fuel management. *See* 73 FR 59567-59568. The Commission concluded that "[t]oday spent fuel is better protected than ever. The results of security assessments, existing security regulations, and the additional protective and mitigative measures imposed since September 11, 2001, provide high assurance that the spent fuel in both spent fuel pools and in dry storage casks will be adequately protected." *Id.*

Some commenters believe that NRC's environmental analysis of the security of spent fuel storage facilities is deficient because it does not include consideration of the environmental impacts of a successful terrorist attack. The commenters recognize that the Commission continues to disagree with the Ninth Circuit and believes that, outside of the Ninth Circuit, the environmental effects of a terrorist attack do not need to be considered in its NEPA analyses. *Amergen Energy Co., LLC* (Oyster Creek Nuclear Generating Station), CLI-07-08, 65 NRC 124 (2007). Recently, the Third Circuit U. S. Court of Appeals upheld NRC's view that terrorist attacks are too far removed from the natural or expected consequences of agency action to require an environmental impact analysis. *New Jersey Department of Environmental Protection v. U.S. Nuclear Regulatory Commission,* 561 F.3d 132 (3d Cir. 2009). The Third Circuit stated:

> In holding that there is no "reasonably close causal relationship" between a relicensing proceeding and the environmental effects of an aircraft attack on the licensed facility, we depart from the reasoning of the Ninth Circuit …. The *Mothers for Peace* court held that, given "the policy goals of NEPA and the rule of reasonableness that governs its application, the possibility of terrorist attack is not so 'remote and highly speculative' as to be beyond NEPA's requirements." …. We note, initially, that *Mothers for Peace* is distinguishable on the ground that it involved the proposed construction of a new facility – a change to the physical environment arguably with a closer causal relationship to a potential terrorist attack than the mere relicensing of an existing facility. …. More centrally, however, we disagree with the rejection of the 'reasonably close causal relationship' test set forth by the Supreme Court and hold that this standard remains the law in this Circuit. We also note that no other circuit has required a NEPA analysis of the environmental impact of a hypothetical terrorist attack.

Id. at 142 (citations and footnote omitted). But even though the NRC continues to believe that the environmental impacts of a terrorist attack do not need to be considered outside of the Ninth Circuit, the environmental assessment for this update and rule amendment includes a discussion of terrorism that the NRC believes satisfies the Ninth Circuit's holding in *Mothers for Peace v. NRC*, as the decision explicitly left to agency discretion the precise manner in which NRC undertakes a NEPA-terrorism review. *See Pacific Gas and Electric Co.* (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation), CLI-08-01, 67 NRC 1 (2008).

Comment 18: TSEP points out that NRC has treated the risk of a catastrophic fuel fire caused by an attack or an accident that leads to partial or complete drainage of a high-density spent fuel storage pool as a site-specific issue, imposing orders requiring NPPs to enhance security and improve their capabilities to respond to terrorist attack. Some of these orders required licensees to develop specific guidance and strategies to maintain or restore spent fuel pool cooling capabilities. *See* 73 FR 59567. TSEP believes that this demonstrates that NRC considers the risk of a pool fire to be specific to each nuclear plant and that site-specific measures to reduce these risks to an acceptable level must be taken at each plant. TSEP believes that this is inconsistent with NRC's reliance on its generic determination in 10 CFR 51.23(a) to deny hearing requests regarding the safety and environmental impacts of spent fuel storage, on contentions that are within the scope of the generic determination, in individual licensing cases. Having acknowledged that its findings regarding the safety and security of spent fuel storage are site-specific and not generic in nature, TSEP believes that NRC should withdraw its generic finding.

NRC Response: After the terrorist attacks of September 11, 2001, the Commission issued orders to NPP and ISFSI licensees requiring enhanced protective measures under its Atomic Energy Act authority to "establish by rule, regulation, or order, such standards and instructions to govern the possession and use of [nuclear materials] as the Commission may deem necessary or desirable to promote the common defense and security or to protect health or to minimize danger to life or property …." 42 U.S.C. § 2201. These orders were site-specific and required each licensee to buttress its security arrangements to achieve the revised standards set by the Commission. Additionally, the orders were used as an expedient method to impose new security requirements on licensees. Subsequently, some of these new requirements were codified in rulemaking. *See* 74 FR 13926; March 27, and 72 FR 12705; March 19, 2007. NRC's determination that SNF can be stored safely and without significant environmental impacts beyond the licensed life for operation of the reactor for at least 60 years is a generic determination made under NEPA. The determination considers reasonably foreseeable risks that could threaten the safety of SNF storage and the environmental impacts of such risks. There is no inconsistency between NRC's orders enhancing security at each plant and its generic determination that SNF can be safely stored because the requirements imposed by the orders and rulemakings help to ensure the safety and security of the SNF. As the Third Circuit said, in its decision upholding NRC's determination that NEPA did not require that NRC consider the environmental effects of an aircraft attack on a licensed facility, the fact that NRC does not have a particular obligation under NEPA does not mean that NRC "has no obligation to consider how to strengthen nuclear facilities to prevent and minimize the effects of a terrorist attack; indeed, the AEA gives broad discretion over the safety and security of nuclear facilities." *New Jersey Department of Environmental Protection v. U.S. Nuclear Regulatory Commission,* 561 F.3d 132, 142 fn 9 (3d Cir. 2009). And, as discussed in the Response to Comment 17*,* the NRC's analysis does satisfy the Ninth Circuit's holding in *San Luis Obispo Mothers for Peace.*

Comment 19: A commenter stated that NRC's implication that above-ground storage may be safely conducted for 60 years beyond the operating license of a reactor does not seem to account for probably rapidly changing climactic conditions in the next few decades. This is very critical since most reactor sites are located near large bodies of water.

NRC Response: The earliest impact to spent fuel storage casks from climate change is not from submergence of structures by rising ocean levels, but rather potentially from an increased risk of flooding from storm surge and high winds caused by extreme weather events. Current NRC regulations for design characteristics specifically address severe weather events. Before certification or licensing of a dry storage cask or ISFSI, respectively, NRC requires that the vendor or licensee design parameters on the ability of the storage and spent fuel storage facilities to withstand severe weather conditions such as hurricanes, tornadoes and floods.

NRC regulations, *see* 10 CFR 72.236 and § 72.122, for casks and facilities, respectively, require that applications for a certificate of compliance for a dry storage cask and a license to store spent fuel in an ISFSI evaluate the effects on the facility from a design basis flood. The evaluation of a design basis flood includes both static pressure from standing water and the force from a uniform flood current. In addition, all storage casks approved for use with the general license provisions in 10 CFR Part 72 have been evaluated for static pressure and uniform flood current in the same manner as those for a specific licensee. The NRC has published regulatory guidance that describes acceptable approaches to assessing these impacts; further, the staff is addressing climate change in updates to its guidance.

Based on NRC's activities related to climate change, and the relatively slow rate of this change, NRC is confident that any regulatory action that may be necessary will be taken in a timely manner to ensure the safety of all nuclear facilities regulated by NRC.

Based on the models discussed in the National Academies (NAS) study (*Potential Impact of Climate Change on U.S. Transportation: Special Report 290),* none of the U.S. NPPs (operational or decommissioned) will be under water or threatened by water levels by 2050. The climate change models used in the NAS study are based on work by the Intergovernmental Panel on Climate Change. Climactic changes over the next century are expected to result in a water level rise of approximately 0.8 meters; *see* J. A. Church *et al, Climate Change 2001: Impacts, Adaptation, and Vulnerability,* Intergovernmental Panel on Climate Change, 642 (2001). Given that dry storage casks are already evaluated for both floods and static pressure from standing water and that climate change will occur slowly (less than 8 mm/year) over the next 100 years, NRC is confident that any regulatory action that may be necessary will be taken in a timely manner to ensure the safety of all nuclear facilities regulated by NRC.

Comment 20: A commenter stated that two events ─ the July 16, 2007, earthquake in Niigata Province, Japan, and an April 2008 earthquake in Michigan ─ and an August 2008 study, which discusses a newly-discovered fault line that could significantly increase estimates of the probability of an earthquake in New York City, undermine confidence in the safety of spent fuel storage. Further, the commenter believes that given the differing seismology of various plants around the country, a generic determination that SNF can be stored safely without significant environmental impacts for long periods of time is inappropriate.

NRC Response: Japan Earthquake of July 2007: Staff reviewed a report that was recently issued by the International Atomic Energy Agency (IAEA) in December 2008. *See* 2d Follow-up IAEA Mission in Relation to the Findings and Lessons Learned from the 16 July 2007 Earthquake at Kashiwazaki-Kariwa NPP, *The Niigataken Chuetsu-oki Earthquake,* Tokyo and Kashiwazaki-Kariwa NPP, Japan, 1-5 December 2008. The report was the third in a series issued by an IAEA-led team of international experts that completed the mission in December 2008. According to this report, "the safe performance of the Kashiwazaki-Kariwa nuclear power plant during and after the earthquake that hit Japan's Niigata and Nagano prefectures on 16 July 2007 has been confirmed." The head of the IAEA's Division of Installation Safety — and the leader of the mission — further stated that "[t]he four reactors in operation at the time in the seven unit complex — the world's largest nuclear power plant — shut down safely and there was a very small radioactive release well below public health and environmental safety limits." The lessons learned from the results of the plant integrity evaluation process will be reviewed by NRC and may be incorporated, as necessary, to improve the approaches for design and evaluation criteria currently used for NPPs in the United States.

August 2008 Study of Seismic Hazard Estimates in the Eastern United States: In August 2008, a technical paper entitled *Observations and Tectonic Setting of Historic and Instrumentally Located Earthquakes in the Greater New York City-Philadelphia Area* by Lynn R. Sykes *et al.* was published in the Bulletin of the Seismological Society of America, Vol. 98, No. 4. NRC staff from the Office of Nuclear Regulatory Research (RES) reviewed this paper to assess the impacts, if any, of this new information on the existing design basis seismic hazard estimates used for NPPs located in this area of Central and Eastern United States (CEUS). RES' assessment was as follows:

In addition to publishing a seismicity map of the area covering the time period from 1677 to 2006, the paper identifies for the first time a boundary in seismicity, with earthquakes with magnitudes less than 3 occurring south of the boundary but not north of it. The boundary intersects the Ramapo Fault on the northwest near Peekskill, NY, and this point appears to coincide with an offset in the Hudson River. The southeast terminus of the boundary is near Stamford, CT, with a length of about 30 miles (50 km). The authors inferred that the boundary is a fault.

If the boundary is a fault, it is only about 30 miles long and much shorter than the Ramapo Fault, which has already been considered in the seismic hazard of the area and in the seismic design of the Indian Point NPPs. The Ramapo Fault was already considered in a probabilistic seismic hazard assessment (PSHA) covering the Indian Point area. The newly identified boundary/fault would not change the maximum magnitude in the PSHA calculations; the Ramapo already controls that. The vast majority of earthquakes identified in the paper, the general seismicity of the area, were known and were used in the US Geological Survey PSHA. Thus, the rate of seismicity used in their PSHA is little changed by the paper. Thus, with the maximum magnitude and the rate of seismicity little changed or unchanged by the paper, the PSHA assessment is not expected to have changed.

This means that the paper would have little overall influence on the perceived hazard near Buchanan, NY.

E-mail from Andrew Murphy to Scott Burnell, Diane Screnci, and Neil Sheehan, August 22, 2008 (ML091530483). The rate of seismicity of the area used in the USGS PSHA is little changed by the information published in the paper. As the maximum magnitude and the rate of seismicity changed little or was practically unchanged by the information in the paper, the USGS PSHA assessment is not expected to change.

The Michigan Earthquake in April 2008: NRC Staff reviewed NRC's *Preliminary Notification of Event or Unusual Occurrence,* PNO-III-08-004A, April 18, 2008 (ML081090639) on the April 2008 earthquake in Michigan. This Notification revealed that licensee personnel and NRC inspectors at the D. C. Cook and Palisades NPPs, both of which experienced onsite seismic activity, conducted independent equipment walkdowns after the initial earthquake and aftershock, and identified no issues. In addition, licensee personnel and NRC inspectors conducted equipment walkdowns at all operating power reactors that felt seismic activity and

also identified no issues. The NRC staff concluded that the earthquake will have little overall influence on the postulated seismic hazard estimates at ISFSIs located in the CEUS.

The seismic design requirements for spent fuel pools are the same as for NPPs; so these events do not undermine confidence in the safety of storage of spent fuel in spent fuel pools. With respect to dry storage, under 10 CFR 72.210, a general license for the storage of spent fuel in an ISFSI is granted to all holders of a license pursuant to 10 CFR Part 50 to possess or operate a NPP. The conditions of this general license are given in 10 CFR 72.212. The conditions of the license require a general licensee to perform written evaluations, prior to use, that establish that: (a) conditions set forth in the Certificate of Compliance (CoC) have been met; (b) cask storage pads and areas have been designed to adequately support the static and dynamic loads of the stored casks, considering potential amplification of earthquakes through soil-structure interaction, and soil liquefaction potential or other soil instability due to vibratory ground motion; and (c) the requirements of 10 CFR 72.104 (dose limitations for normal operation and anticipated occurrences) have been met. Additionally, the ISFSI foundation analysis must include soil-structure interaction and must address liquefaction potential. *See* 10 CFR 72.212(b)(2). Further, 10 CFR 72,212(b)(3) requires that a general licensee "[r]eview the Safety Analysis Report (SAR) referenced in the [CoC] and the related NRC Safety Evaluation Report, prior to use of the general license, to determine whether or not the reactor site parameters, including analyses of earthquake intensity and tornado missiles, are enveloped by the cask design bases considered in these reports."

In the continental United States, geographic areas located east of the Rocky Mountain Front (east of approximately 104 degrees west longitude) are generally known as "CEUS." For NPP sites that have been evaluated under the criteria of 10 CFR Part 100, Appendix A, the Design

Earthquake must be equivalent to the safe shutdown earthquake for the NPP, but in no case less than 0.10g. For the existing NPPs in the United States, the design basis response spectra used for the design of dry cask storage systems are based on the response spectrum defined in NRC Regulatory Guide 1.60, "Design Response Spectra for Seismic Design of Nuclear Power Plants," Rev. 1, December 1973, anchored at a Peak Ground Acceleration of 0.3g in the horizontal direction and 0.2g in the vertical direction.

As a condition for utilizing a general license to operate an ISFSI, licensees are required to perform written evaluations to establish, for their site-specific conditions, that the conditions set forth in the CoC have been met and that cask storage pads and areas have been designed to adequately support the static and dynamic loads of the stored casks, considering potential amplification of earthquakes through soil-structure interaction, and soil liquefaction potential or other soil instability due to vibratory ground motion. The Indian Point, Vermont Yankee, and Palisades NPPs, which were specifically cited in the comment, have ISFSIs co-located at their existing NPPs and are operating their ISFSIs under an NRC general license. Entergy Nuclear Generation Company has not announced plans for storage of spent fuel in dry casks at the Pilgrim NPP.

Based on currently available information, NRC concludes that the design-basis earthquake evaluated for issuance of the CoCs for the storage casks storing fuel at the ISFSIs co-located at Indian Point, Vermont Yankee, and Palisades (all in CEUS) are appropriate. Additionally, the storage cask analyses and designs provide an adequate safety margin and comply with the requirements in 10 CFR Part 72 for use by a general licensee. Since Generic Issue No. 199, "Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants," November 17, 2008, is still an open issue, implications of any new

information and its effects, if any, on CEUS/ISFSI seismic design for the storage casks and/or support pads will be evaluated. In summary, the information provided by the commenters have little overall influence on the postulated seismic hazard estimates in the CEUS.

Comment 21: A commenter believes that NRC, in judging the safety and security of onsite storage for time periods extending to the middle of the next century, should seriously consider the safety of subsequent pick-up and transport of the SNF.

NRC Response: NRC's regulations establish the safety standards for the design, construction and use of spent fuel transportation packages. *See* 10 CFR Part 71. The NRC conducts rigorous independent reviews to certify that spent fuel transportation packages meet the design standards and test conditions in the regulations. In addition, NRC reviews and approves the operational procedures and conditions for use of the transport package. These requirements include maintenance of the transport package in full conformance with the NRC-approved package design and material conditions, and the requirements include strict adherence to the NRC-approved operating procedures for the preparation for and loading of the spent fuel transport package. The requirements for use of an NRC-approved spent fuel transport package apply irrespective of how long the spent fuel may have been in interim storage.

Packages that are designed, tested, operated and maintained according to NRC requirements will provide for safe transport of spent fuel. Spent fuel packages are very robust and are designed to withstand severe accidents. Numerous studies and physical testing programs have demonstrated that the safety standards NRC uses to certify transportation packages provide a very high degree of protection against real world accidents. *See* NUREG/CR-4829, *Shipping Container Response to Severe Highway and Railway Accident*

Conditions; NUREG/CR-6894, *Spent Fuel Transportation Package Response to the Caldecott Tunnel Fire Scenario*; NUREG/CR-6886, *Spent Fuel Transportation Package Response to the Baltimore Tunnel Fire Scenario*; NUREG-0170, *Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes*; "Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States," National Research Council of the National Academies, National Academies Press, Washington DC, 2006. Additionally, NRC periodically reviews the basis for the transportation regulations to ensure that the regulations continue to provide an adequate level of safety for the shipment of spent fuel. These reviews account for changes in analytical methods, materials, package contents and operating history. A recent review confirmed that initial transportation studies done in the 1970s (which are the basis for NRC's regulations) contained very conservative assumptions and that the risk to the public from transportation of spent fuel is very low. *See* NUREG/CR-6672, *Reexamination of Spent Fuel Shipment Risk Estimates,* March 2000. The same robust design features that make spent fuel packages safe also make them secure from terrorist attack.

Comment 22: A number of commenters expressed the view that a centralized interim storage facility would be a safe and cost-effective option for managing and storing SNF until a repository is available. The Decommissioning Plant Coalition (DPC) noted that in 1990 the Commission expressed support for timely disposal of SNF and HLW and stated that it did not intend to support storage of spent fuel for an indefinitely long period, *see* 55 FR 38482 (1990). The DPC urges the Commission to explicitly reaffirm this position and, further, express its expectation that the Federal Government soon provide a demonstration that it can reach a consensus on a plan to take title to and remove SNF and Greater-Than-Class C (GTCC) waste from permanently shut-down, single-site facilities. The DPC outlines the burdens imposed on decommissioned

sites by continuing long-term onsite storage, such as restricting the property owners and other local stakeholders from other potential uses for the site. The National Association of Regulatory Utility Commissioners agrees with NRC that today SNF is better protected than ever, but also believes that the SNF will be even more secure in a centralized interim storage or permanent disposal facility. The DPC also takes exception to NRC's "analysis" of difficulties that may block the opening of the Private Fuel Storage ISFSI and the NRC's "analysis" of a February 2006 National Academies (NAS) study, in footnote 24 of the proposed Update, and would like the footnote eliminated or rewritten.

NRC Response: The Commission continues to support timely disposal of HLW and SNF but recognizes, in this Waste Confidence Decision, that storage of SNF may have to continue for a 50-60 year period after licensed operation of a reactor. The Commission agrees that centralized interim storage would be an acceptable method for managing and storing SNF until a repository is available, but determining when DOE will take spent fuel and GTCC wastes from reactor sites and how such waste will then be managed are issues for DOE to resolve.

NRC's proposed Update noted that issuance of a license to the Private Fuel Storage ISFSI confirmed the feasibility of licensing an away-from-reactor ISFSI under Part 72, but observed that several issues would have to be resolved before this ISFSI could be built and operated. *See* 73 FR 59566. Footnote 24 identified these issues as being two approvals needed from the Department of the Interior and a NAS Report on the transport of SNF in the United States (National Research Council 2006, *Going the Distance: The Safe Transport of [SNF and HLW] in the United States)*. The footnote is not intended as an analysis of these issues; it is merely an acknowledgement of issues raised by the Department of the Interior and NAS that need to be addressed. With respect to PFS, the DPC states: "The Commission would do well to comment

that it is THE safe and secure licensed facility that should be utilized to reduce waste confidence concerns. You can observe, consistent with historical Commission concerns about dual and multiple regulation, that legislation can effect a reduction in the multiple and redundant political and regulatory jurisdictions over use of such facilities." The license issued to PFS demonstrates that the Commission believes it can be constructed and operated without jeopardizing public health and safety, but it is up to the licensee and other agencies to resolve issues within their purview that may block construction of the facility.

Issue 8: Miscellaneous Comments

Comment 23: One commenter stated that the proposed rulemaking appears to countenance the stranding of SNF at or near plant sites for up to 150 years or more and contains no effective or reasonable timeframe in 20 or so years to revisit this matter, or to contain any form of limitations, guidelines, or other provisions to ensure the ultimate safe and proper disposal of SNF.

NRC Response: The Commission, in its 1999 review of the Waste Confidence Decision, stated that it would consider undertaking a comprehensive reevaluation of the Waste Confidence findings when the impending repository development and regulatory activities run their course or if significant and pertinent unexpected events occur, raising substantial doubt about the continuing validity of the Waste Confidence findings. *See* 64 FR 68005 (1999). Although the Commission did not undertake its present review of the Waste Confidence Decision because it believed these criteria had been met, the ultimate disposition of the Yucca Mountain application is uncertain. The Commission's update reflects the uncertainty regarding the ultimate grant or denial of the Yucca Mountain license by conservatively considering the possibility that the

license is not granted. For this reason, termination of the Yucca Mountain program would not be a basis for a further review of the Waste Confidence Decision. However, if significant and pertinent unexpected events occur, raising substantial doubt about the continuing validity of the Waste Confidence findings, the Commission will consider undertaking a review of the Waste Confidence Decision.

Comment 24: A commenter stated that the cost of the proposed rule change is only briefly and minimally discussed and expressed the view that there would be significant costs to both ratepayers and taxpayers stemming from storage of this waste for an additional 50 to 60 years at plant sites. The commenter recommended that the full cost of implementing this rule be completely evaluated by NRC under NRC's Regulatory Analyses Guidelines and the legislative requirements for assessing the impacts of proposed rules which have a certain threshold cost. TSEP believes it is not reasonable to assume that the present 1.0 mil per kWh fee will suffice to pay for the U.S. repository program.

NRC Response: The Commission's action of enlarging its generic determination in 10 CFR 51.23(a) by 30 years is not a licensing decision and does not give permission to reactor licensees to store spent fuel that they don't already possess (or may not obtain) under a Part 72 general or specific license. *See* Response to Comment 6. Finding 4 only states the Commission's reasonable assurance that SNF can be stored safely and without significant environmental impact for at least 60 years beyond the licensed life for operation of any reactor, *if necessary.* The NRC generally provides a Regulatory Analysis for actions that "would affect a change in the use of resources by its licensees." *Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission,* NUREG/BR-0058, Sept. 2004, p.5. A Regulatory Analysis may be appropriate when NRC is considering placing burdens on its licensees through a

licensing or regulatory action, *e.g.*, in the prospective ISFSI security rulemaking, but such is not the case here. The NRC recognizes that many commenters are concerned about the burden placed on ratepayers charged by utilities for the cost of continued storage of SNF at reactor sites and on taxpayers paying the cost of DOE's default in failing to remove SNF from reactor sites as specified in DOE's contracts with the utilities. However, until DOE is able to fulfill its contracts, these burdens will exist irrespective of this Waste Confidence rulemaking.

The fee mandated by the NWPA that reactor licensees must pay into the Nuclear Waste Fund to provide for eventual disposal of HLW and SNF has so far been more than adequate to support DOE's HLW program with approximately $21 billion in the Fund in July 2008. *See* Statement of Edward F. Sproat, III, before the Subcommittee on Energy and Air Quality, Committee on Energy and Commerce, U.S. House of Representatives, July 15, 2008, p. 6.[7] Moreover, the NWPA provides a mechanism for increasing the fee if the current fee becomes inadequate to cover costs. *See* Section 302(a)(4) of NWPA, 42 U.S.C. § 10222. DOE has periodically issued a total system cost estimate for the disposal program to provide a basis for assessing the adequacy of the fee. *See, e.g., Analysis of the Total System Life Cycle Cost of the Civilian Radioactive Waste Management Program, Fiscal Year 2007,* DOE/RW-0591, July 2008.

Comment 25: A commenter raised the question of how the Commission's expectation that repository capacity can reasonably be expected to be available within 50-60 years beyond the licensed life for operation of any reactor would be met in the case of the Humboldt Bay 3 NPP

[7] Congress must make annual appropriations for the HLW program from the Fund, so the amount actually available to DOE in any given year is dependent upon the amount appropriated.

which was decommissioned in 1976, meaning that 50 years beyond its decommissioning would be 2026. The commenter asked if this meant that SNF would be removed from Humboldt Bay 3 by 2026 and, if so, what is the need for amending Finding 2.

NRC Response: The commenter has confused the end of operation of the reactor with the end of the licensed life for operation. Humboldt Bay 3 was issued a 40-year operating license in 1962. The end of its *licensed life for operation*, therefore, was 2002 and 50 years beyond that would be 2052. Even if a reactor is retired prematurely, resulting in the need to manage and store SNF for a longer period after the end of reactor operation, the Commission is confident, for all the reasons expressed in reaching Findings 3 and 4, that management and storage of the SNF will be conducted safely and securely without significant impact to the environment.

Evaluation of Waste Confidence Findings

Having considered the comments received on the Commission's proposed Waste Confidence findings, the Commission now reexamines the 1984 and 1990 bases of its findings and supplements those bases with an evaluation of events and issues that have arisen since 1990 and affect the findings.

I. Finding 1: The Commission finds reasonable assurance that safe disposal of high-level radioactive waste and spent fuel in a mined geologic repository is technically feasible.

A. Bases for Finding 1.

The Commission reached this finding in 1984 and reaffirmed it in 1990. The focus of this finding is on whether safe disposal of HLW and SNF is technically possible using existing technology and without a need for any fundamental breakthroughs in science and technology. To reach this finding, the Commission considered the basic features of a repository designed for a multi-barrier system for waste isolation and examined the problems the Department of Energy (DOE) would need to resolve in developing a final design for such a repository. The Commission identified three major technical problems: (1) the selection of a suitable geologic setting as host for a technically acceptable repository site; (2) the development of waste packages that will contain the waste until the fission products are greatly reduced; and (3) the development of engineered barriers, such as backfilling and sealing of the drifts and shafts of the repository, which can effectively retard migration of radionuclides out of the repository (49 FR 34667; August 31, 1984).

DOE's selection of a suitable geologic setting has been governed by the Nuclear Waste Policy Act of 1982, Pub.L. 97-425, 42 U.S.C. 10101 *et seq.* (NWPA) and by the 1987 amendments to NWPA in the Nuclear Waste Policy Amendments Act, Pub.L. 100-202 (NWPAA). DOE explored potential repository sites before the NWPA, but that Act set in place a formal process and schedule for the development of two geologic repositories. The following brief summary of key provisions of these Acts may assist readers in understanding DOE's process for locating a suitable geologic setting.

As initially enacted, NWPA directed DOE to issue guidelines for the recommendation of sites and then to nominate at least 5 sites as suitable for site characterization for selection as the first

repository site and, not later than January 1, 1985, to recommend 3 of those sites to the President for characterization as candidate sites. Section 112 of NWPA, 42 U.S.C. 10132. Not later than July 1, 1989, DOE was to again nominate 5 sites and recommend 3 of them to the President for characterization for selection as the second repository. *Id.* DOE was then to carry out site characterization activities for the approved sites. Section 113 of NWPA, 42 U.S.C. 10133. Following site characterization, DOE was to recommend sites to the President as suitable for development as repositories and the President was to recommend one site to the Congress by March 31, 1987, and another site by March 31, 1989, for development as the first two repositories. Section 114 of NWPA, 42 U.S.C. 10134. States and affected Indian tribes were given the opportunity to object, but if the recommendations were approved by Congress, DOE was to submit applications for a construction authorization to NRC. *Id.* NRC was given until January 1, 1989, to reach a decision on the first application, and until January 1, 1992, on the second. The Commission was directed to prohibit the emplacement in the first repository of more than 70,000 metric tons of heavy metal (MTHM) until a second repository was in operation. *Id.* The 1987 NWPAA, *inter alia,* restricted site characterization solely to a site at Yucca Mountain, NV (YM) and terminated the program for a second repository. The NWPAA provided that if DOE at any time determines YM to be unsuitable for development as a repository, DOE must report to Congress its recommendations for further action to ensure the safe, permanent disposal of SNF and HLW, including the need for new legislation. Section 113 of NWPA, as amended, 42 U.S.C. 10133.

In 1984, the Commission reviewed DOE's site exploration program and concluded that it was providing information on site characteristics at a sufficiently large number and variety of sites and geologic media to support the expectation that one or more technically acceptable sites would be identified (49 FR 34668; August 31, 1984). In 1990, the Commission noted that

the 1987 amendment of NWPA, which focused solely on the YM site, could cause considerable delay in opening a repository if that site were found to be unlicenseable. But the possibility of that delay did not undermine the Commission's confidence that a technically acceptable site would be located, either at YM or elsewhere. The Commission observed that the NRC staff had provided extensive comments on DOE's draft environmental assessments of the 9 sites it had identified as being potentially acceptable and on the final environmental assessments for the 5 sites nominated.[8] NRC had not identified any fundamental technical flaws or disqualifying factors that would render any of the sites unsuitable for characterization or potentially unlicenseable, although NRC noted that many issues would need to be resolved during site characterization for YM or any other site (55 FR 38486; September 18, 1990).

With respect to the development of effective waste packages, the Commission, in 1984, reviewed DOE's scientific and engineering program on this subject. The Commission also considered whether the possibility of renewed reprocessing of SNF could affect the technical feasibility of the waste package because it would need to consider a waste form other than spent fuel. The Commission concluded that the studies of DOE and others demonstrated that the chemical and physical properties of SNF and HLW can be sufficiently understood to permit the design of a suitable waste package and that the possibility of commercial reprocessing would not substantially affect this conclusion (49 FR 34671; August 31, 1984). In 1990, the Commission reviewed DOE's continued research and experimentation on waste packages, which primarily focused on work in Canada and Sweden. NRC noted that DOE had narrowed

[8] Under the program established by the initial NWPA, DOE had nominated sites at Hanford WA, Yucca Mountain, NV, Deaf Smith County, TX, Davis Canyon, UT, and Richton Dome, MS, and had recommended the first 3 sites for site characterization.

the range of waste package designs to a design tailored for unsaturated tuff[9] at the YM site due to the 1987 redirection of the HLW program. NRC also noted that some reprocessing wastes from the defense program and the West Valley Demonstration Project were now anticipated to be disposed in the repository. NRC remained confident that, given a range of waste forms and conservative test conditions, the technology is available to design acceptable waste packages (55 FR 38489; September 18, 1990).

With respect to the development of effective engineered barriers, the Commission's confidence in 1984 rested upon its consideration of DOE's ongoing research and development activities regarding backfill materials and borehole and shaft sealants that led it to conclude that these activities provided a basis for reasonable assurance that engineered barriers can be developed to isolate or retard radioactive material released by the waste package (49 FR 34671; August 31, 1984). In 1990, although DOE's research had narrowed to focus on YM, the Commission continued to have confidence that backfill or packing materials can be developed as needed for the underground facility and waste package and that an acceptable seal can be developed for candidate sites in different geologic media (55 FR 38489-38490; September 18, 1990).

B. Evaluation of Finding 1.

Today, the scientific and technical community engaged in waste management continues to have high confidence that safe geologic disposal is achievable with currently available

[9] Tuff is a type of rock consisting of successive layers of fine-grained volcanic ash. *See* DOE/RW-0573, Rev. 0 *Yucca Mountain Repository GI.*

technology. S*ee, e.g.,* National Research Council, *"Technical Bases for Yucca Mountain Standards,"* 1995. No insurmountable technical or scientific problem has emerged to disturb this confidence that safe disposal of SNF and HLW can be achieved in a mined geologic repository. To the contrary, there has been significant progress in the scientific understanding and technological development needed for geologic disposal over the past 18 years. There is now a much better understanding of processes that affect the ability of repositories to isolate waste over long periods. *Id. a*t 71-72; International Atomic Energy Agency (IAEA), "Scientific and Technical Basis for the Geologic Disposal of Radioactive Wastes, Technical Reports Series No. 413," 2003. And the ability to characterize and quantitatively assess the capabilities of geologic and engineered barriers has been repeatedly demonstrated. NRC, "Disposal of High-Level Radioactive Wastes in a Proposed Geologic Repository at Yucca Mountain, Nevada; Proposed Rule," (64 FR 8640, 8649; February 22, 1999); Organization for Economic Cooperation and Development, Nuclear Energy Agency, "Lessons Learned from Ten Performance Assessment Studies," 1997. Specific sites have been investigated and extensive experience has been gained in underground engineering. IAEA, "Radioactive Waste Management Studies and Trends, IAEA/WMDB/ST/4," 2005; IAEA, "The Use of Scientific and Technical Results from Underground Research Laboratory Investigations for the Geologic Disposal of Radioactive Waste, IAEA-TECDOC-1243," 2001. These advances and others throughout the world continue to confirm the soundness of the basic concept of deep geologic disposal. IAEA, "Joint Convention on Safety of Spent Fuel Management and on Safety of Radioactive Waste Management, INFCIRC/546," 1997.

In the United States, the technical approach for safe HLW disposal has remained unchanged for several decades: Use a deep geologic repository containing natural barriers to hold canisters of HLW with additional engineered barriers to further retard radionuclide release.

Although some elements of this technical approach have changed in response to new knowledge (*e.g.*, engineered backfill was removed as a design concept for YM in the late 1990s in response to enhanced understandings of heat and water transfer processes in the near-field drift environment), safe disposal still appears to be feasible with current technology. In 1998 DOE conducted assessments for long-term performance of a potential repository at YM (DOE/RW-0508, Viability Assessment) and 2002 (DOE/RW-0539, Site Recommendation). These assessments used existing technology and available scientific information and did not identify areas where fundamental breakthroughs in science or technology were needed to support safe disposal.

With respect to the issue of identifying a suitable geologic setting as host for a technically acceptable site, DOE made its suitability determination for the YM site in 2002. On June 3, 2008, DOE submitted the application for construction authorization to NRC and on September 8, 2008, NRC Staff notified DOE that it found the application acceptable for docketing (73 FR 53284; September 15, 2008). Whether YM is technically acceptable must await the outcome of an NRC licensing proceeding. And even if DOE does not construct a repository at YM, such an occurrence would not change the fact that the Commission continues to have reasonable assurance that the technology exists today to safely dispose of SNF and HLW in a geologic repository. Although the 1987 amendments to NWPA barred DOE from continuing site investigations elsewhere, the U.S. Congress' decision to focus solely on YM was not based on any finding that any of the other sites were unsuitable for technical reasons; rather, the decision was aimed at controlling the costs of the HLW program (55 FR 38486; September 18, 1990).

Repository programs in other countries, which could inform the U.S. program, are actively considering crystalline rock, clay, and salt formations as repository host media. IAEA, "Radioactive Waste Management Status and Trends, IAEA/WMDB/ST/4," 2005; IAEA, "The Use of Scientific and Technical Results from Underground Research Laboratory Investigations for the Geologic Disposal of Radioactive Waste, IAEA-TECDOC-1243," 2001. Many of these programs have researched these geologic media for several decades. Although there are relative strengths to the capabilities of each of these potential host media, no geologic media previously identified as a candidate host, with the exception of salt formations for spent nuclear fuel, has been ruled out based on technical or scientific information. Salt formations are being considered as hosts only for reprocessed nuclear materials because heat-generating waste, like spent nuclear fuel, exacerbates a process by which salt can rapidly deform. This process could cause problems for keeping drifts stable and open during the operating period of a repository.

In 2001, NRC amended its regulations to include a new 10 CFR Part 63, "Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada," (66 FR 55732; November 2, 2001). Part 63 requires use of both natural and engineered barriers to meet overall total system performance objectives without pre-determined subsystem performance requirements, which are required in 10 CFR Part 60.[10] Accordingly, U.S. research and development activities have focused on understanding the long-term capability of natural and engineered barriers, which can prevent or substantially reduce the release rate of radionuclides from a potential repository system. Although the performance of individual barriers may change

[10] NRC's regulations at 10 CFR Part 63 apply only to the proposed repository at YM. NRC's regulations at 10 CFR Part 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories," govern the licensing of any repository other than one located at YM. However, at the time Part 63 was proposed, the Commission indicated it would consider revising Part 60 if it seemed likely to be used in the future. (64 FR 8640, 8643; February 22, 1999).

through time, the overall performance of the total system is required to be acceptable throughout the performance period for the repository. In this context of total system performance, research and development has found that it appears technically possible to design and construct a waste package and an engineered barrier system that, in conjunction with natural barriers, could prevent or substantially reduce the release rate of radionuclides from a potential repository system during the performance period. NRC, "Disposal of High-Level Radioactive Wastes in a Proposed Geologic Repository at Yucca Mountain, Nevada; Proposed Rule," (64 FR 8649; February 22, 1999); IAEA, "Joint Convention on Safety of Spent Fuel Management and on Safety of Radioactive Waste Management, INFCIRC/546," 1997.

Since the Commission last considered Waste Confidence issues, NRC has issued design certifications for new reactors under its regulations at 10 CFR Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants," and is currently reviewing several plant designs in response to applications for design certifications. NRC is also considering COL applications for nuclear power plants that reference these certified and under-review designs. These facilities would use the same or similar fuel assembly designs as the nuclear power plants currently operating in the United States. If these new facilities use a new fuel type or different cladding, then it may be necessary to modify the design of a repository to accommodate these changes. But if limited reliance is placed on the barrier capabilities of cladding or fuel type to comply with repository safety requirements, then minimal design changes may be needed to accommodate new types of SNF or cladding. As such, the new reactor designs and specific license applications currently under review would not raise issues as to the technical feasibility of repository disposal.

NRC is also engaged in preliminary interactions with DOE and possible reactor vendors proposing advanced reactor designs that are different from the currently operating light-water reactors. Some of these advanced reactors use gas-cooled or liquid metal cooled technologies and have fuel and reactor components that might require different transportation and storage containers. Geometric, thermal, and criticality constraints could conceivably require a design modification to disposal containers from those currently proposed for YM. Nevertheless, the technical requirements for disposal of advanced reactor components appear similar to the requirements for disposal of components for current light water reactors. For example, DOE had planned to dispose of spent fuel at YM from both gas-cooled (Peach Bottom 1) and liquid-metal cooled (Fermi 1) reactors, using the same basic technological approach as for SNF from light water reactors. Although radionuclide inventory, fuel matrix, and cladding characteristics for advanced fuels might be distinct from current light-water reactors, the safe disposal of advanced fuel appears to involve the same scientific and engineering knowledge as used for fuel from current light-water reactors.

There is currently a high uncertainty regarding the growth of advanced reactors in the U.S. The licensing strategy developed by NRC and DOE for the next generation nuclear plant (NGNP) program found that an aggressive licensing approach may lead to operation of a prototype facility in 2021. Based on comparison with current disposal strategies for fuel from existing gas cooled or liquid-metal cooled reactors, NRC is confident that current technology is adequate to support the safe disposal of spent fuel from a potential prototype facility. In addition to the NGNP activities related to the prototype reactor, various activities, such as DOE's Advanced Fuel Cycle Initiative, are underway to evaluate fuel cycle alternatives that could affect the volume and form of waste from the prototype reactor or other nuclear reactor designs. The need to consider waste disposal as part of the overall research and development activities for

advanced reactors is recognized and included in the activities of designers, DOE, and NRC. *See, e.g.,* DOE Nuclear Energy Research Advisory Committee and the Generation IV International Forum, "A Technology Roadmap for Generation IV Nuclear Energy Systems," December 2002.

Based on the above discussion, including its response to the public comments, the Commission reaffirms Finding 1.

II. Finding 2 (1990): The Commission finds reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and that sufficient repository capacity will be available within 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of any reactor to dispose of the commercial high-level radioactive waste and spent fuel originating in such reactor and generated up to that time.

A. Bases for Finding 2.

The dual objectives of this finding are to predict when a repository will be available for use and to predict how long spent fuel may need to be stored at a reactor site until repository space is available for the spent fuel generated at that reactor. With respect to the first prediction, the Commission's focus in 1984 was on the years 2007-2009, the years during which the operating licenses for the Vermont Yankee[11] and Prairie Island[12] nuclear power plants would expire.[13] In

[11] The Commission amended Vermont Yankee's operating license on January 23, 1991, to extend the expiration date of the license to 2012. (56 FR 2568; January 24, 2991). Vermont Yankee has applied for a license renewal, which is being reviewed by the Commission and would (continued. . .)

1984, DOE anticipated that the first repository would begin operation in 1998 and the second in 2004. But NRC concluded that technical and institutional uncertainties made it preferable to focus on the 2007-2009 time period. The technical uncertainties involved the questions of how long it would take DOE to locate a suitable geologic setting for a potentially technically acceptable repository and how long it would take to develop an appropriate waste package and engineered barriers. The Commission expressed the view that despite early delays DOE's program was on track and, under the impetus given by the recently-enacted NWPA, would timely resolve the technical problems (49 FR 34674-34675; August 31, 1984).

The Commission also identified institutional uncertainties that needed to be resolved: (1) Measures for dealing with Federal-state disputes; (2) An assured funding mechanism that would be sufficient over time to cover the period for developing a repository; (3) An organizational capability for managing the HLW program; and (4) A firm schedule and establishment of responsibilities. The Commission expressed its confidence in the ability of the provisions of the

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(. . .continued)
extend the plant's operating license for 20 years.
http://www.nrc.gov/reactors/operating/licensing/renewal/applications.html (last visited June 1, 2009).

[12] The Commission amended Prairie Island 1 and 2's operating licenses on September 23, 1986, to extend the expiration date of the licenses to August 9, 2013, and October 29, 2014. ML022200335. Prairie Island 1 and 2 have applied for license renewals, which are being reviewed by the Commission and would extend the plants' operating license for 20 years. http://www.nrc.gov/reactors/operating/licensing/renewal/applications.html (last visited June 1, 2009).

[13] Under the court remand which precipitated the initial waste confidence review, NRC was required to consider whether there was reasonable assurance that an offsite storage solution would be available by the years 2007-2009 and, if not, whether there was reasonable assurance that the spent fuel could be stored safely at those sites beyond those dates. *See State of Minnesota v. NRC,* 602 F.2d 412, 418 (D.C. Cir. 1979).

then recently-passed NWPA to timely resolve these uncertainties (49 FR 34675-34679; August 31, 1984).

With respect to the second prediction, NRC reviewed DOE's estimates of the amount of installed generating capacity of commercial nuclear power plants in the year 2000 and concluded that the total amount of spent fuel that would be produced during the operating lifetimes of these reactors would be about 160,000 MTHM. To accommodate this volume of spent fuel, NRC assumed that two repositories would be needed. NRC calculated that if the first repository began to receive SNF in 2005 and the second in 2008, then all the SNF would be emplaced by about 2026. This would mean that sufficient repository capacity would be available within 30 years beyond the expiration of any reactor license for disposal of its SNF (49 FR 34679; August 31, 1984).

In reviewing these predictions in 1990, the Commission faced a considerably changed landscape. First, DOE's schedule for the availability of a repository had slipped several times so that its then-current projection was 2010. Second, Congress' 1987 amendment of NWPA had confined site characterization to the YM site, meaning that there were no "back-up" sites being characterized in case the YM site were found unsuitable or unlicenseable. Finally, site characterization activities at YM had not proceeded without problems, notably in DOE's schedule for subsurface exploration and in development of its quality assurance program. Given these considerations, the Commission found it would not be prudent to reaffirm its confidence in the availability of a repository by 2007-2009 (55 FR 38495; September 18, 1990).

Instead, the Commission found that it would be reasonable to assume that DOE could make its finding whether YM was suitable for development of a repository by the year 2000. The

Commission was unwilling to assume that DOE would make a finding of suitability (which would be necessary for a repository to be available by 2010). To establish a new timeframe for repository availability, the Commission made the assumption that DOE would find the YM site unsuitable by the year 2000 and that (as DOE had estimated) it would take 25 years for a repository to become available at a different site. The Commission then considered whether it had sufficient bases for confidence that a repository would be available by 2025 using the same technical and institutional criteria it had used in 1984. The Commission found no reason to believe that another potentially technically acceptable site could not be located if the YM site were found unsuitable. The development of a waste package and engineered barriers was tied up with the question of the suitability of the YM site, but NRC found no reason to believe that a waste package and engineered barriers could not be developed for a different site by 2025, if necessary (55 FR 38495; September 18, 1990). The institutional uncertainties were perhaps more difficult to calculate. The Commission acknowledged that DOE's efforts to address the concerns of states, local governments and Indian tribes had met with mixed results. Nevertheless, the Commission retained its confidence that NWPA, as amended, had achieved the proper balance between providing for participation by affected parties and providing for the exercise of Congressional authority to carry out the national program for waste disposal (55 FR 38497; September 18, 1990). Similarly, the Commission believed that management and funding issues had been adequately resolved by NWPA, as amended, and would not call into question the availability of a repository by 2025 (55 FR 38497-38498; September 18, 1990). Thus, except for the schedule, the Commission was confident that the HLW program set forth in the amended NWPA would ultimately be successful.

The Commission also considered whether the termination of activities for a second repository, combined with the 70,000 MTHM limit for the first repository, together with its new

projection of 2025 as the date for the availability for a repository, undermined its assessment that sufficient repository capacity would be available within 30 years beyond expiration of any reactor operating license to dispose of the SNF originating in such reactor and generated up to that time (55 FR 38501-38504; September 18, 1990). The Commission noted that almost all reactor licenses would not expire until some time in the first three decades of the twenty-first century and license renewal was expected to extend the terms of some of these licenses. Thus, a repository was not needed by 2007-2009 to provide disposal capacity within 30 years beyond expiration of most operating licenses.[14] The Commission acknowledged, however, that it appeared likely that two repositories would be needed to dispose of all the SNF and HLW from the current generation of reactors unless Congress provided statutory relief from the 70,000 MTHM limit for the first repository and unless the first repository had adequate capacity to hold all the SNF and HLW generated. This was because DOE's 1990 spent fuel projections, which assumed that no new reactors would be constructed, called for 87,000 MTHM to be generated by 2036. The Commission believed that that assumption probably underestimated the expected total spent fuel discharges due to the likelihood of reactor license renewals. Further, the Commission expressed the belief that if the need for a second repository was established, Congress would provide the needed institutional support and funding, as it had for the first repository.[15] The Commission reasoned that if work began on the second repository program in

[14] NRC identified Dresden 1, licensed in 1959, as the earliest licensed power reactor and noted that 30 years beyond its licensed life for operation would be 2029 and that it was possible, if a repository were to become available by 2025, for all the Dresden 1 SNF to be removed from that facility by 2029 (55 FR 38502; September 18, 1991).

[15] DOE is statutorily required to report to the President and to Congress on the need for a second repository between January 1, 2007, and January 1, 2010. Section 161 of NWPA, as amended, 42 U.S.C. 10172a. DOE submitted the report to Congress in December 2008. The report recommended that Congress remove the 70,000 MTHM limit for the YM repository, but Congress has not yet responded to the report. The Report to the President and the Congress by the Secretary of Energy on the Need for a Second Repository, 1, (2008) available at
(continued. . .)

2010, that repository could be available by 2035. Two repositories available in approximately 2025 and 2035, each with acceptance rates of 3400 MTHM/year within several years after commencement of operations, would provide assurance that sufficient repository capacity will be available within 30 years of operating license expiration for reactors to dispose of the spent fuel generated at their sites up to that time. The Commission concluded that a second repository, or additional capacity at the first repository, would be needed only to accommodate the additional quantity of spent fuel generated during the later years of reactors operating under a renewed license. The Commission stated that the availability of a second repository would permit spent fuel to be shipped offsite well within 30 years after expiration of these reactors' operating licenses and that the same would be true of the spent fuel discharged from any new generation of reactor designs (55 FR 38503-38504; September 18, 1990).

The Commission acknowledged that there were several licenses that had been prematurely terminated where it was possible that SNF would be stored more than 30 years beyond the effective expiration of the license and that there could be more of these premature terminations. But the Commission remained confident that in these cases the overall safety and environmental impacts of extended spent fuel storage would be insignificant. The Commission found that spent fuel could be safely stored for at least 100 years (Finding 4)[16] and that spent fuel in at-reactor storage would be safely maintained until disposal capacity at a repository was available (Finding 3). The Commission emphasized that it had not identified a date by which a

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http://www.ocrwm.doe.gov/uploads/1/Second_Repository_Rpt_120908.pdf. (last visited on May 22, 2009).

[16] The Commission conservatively assumed that licenses would be renewed for 30 year terms (55 FR 38503; September 18, 1990). Thus, the initial 40 year term of the operating license, plus 30 years for the renewed operating license term and 30 years beyond the expiration of the renewed license amounts to storage for at least 100 years.

repository must be available for health and safety reasons. Under the second part of Finding 2, safe management and safe storage would not need to continue for more than 30 years beyond expiration of any reactor's operating license because sufficient repository capacity was expected to become available within those 30 years (55 FR 38504; September 18, 1990).

B. Evaluation of Finding 2.

As explained previously, the Commission based its estimate in 1990—that at least one geologic repository would be available within the first quarter of the twenty-first century—on an assumption that DOE would make its suitability determination under section 114 of NWPA around 2000. To avoid being put in the position of assuming the suitability of the YM site, the Commission then assumed that DOE would find that site unsuitable and, as DOE had estimated, that it would take 25 years before a repository could become available at an alternate site.

DOE made its suitability determination in early 2002 and found the YM site suitable for development as a repository.[17] Although DOE's application for a construction authorization for a repository was considerably delayed from the schedule set out in NWPA[18], on June 3, 2008,

[17] On February 14, 2002, the Secretary of Energy recommended the YM site for the development of a repository to the President thereby setting in motion the approval process set forth in sections 114 and 115 of the NWPA. *See* 42 U.S.C. 10134(a)(1); 10134(a)(2); 10135(b), 10136(b)(2). On February 15, 2002, the President recommended the site to Congress. On April 8, 2002, the State of Nevada submitted a notice of disapproval of the site recommendation to which Congress responded, on July 9, 2002, by passing a joint resolution approving the development of a repository at YM which the President signed on July 23, 2002. See Pub. L. No. 107-200, 116 Stat. 735 (2002) (codified at 42 U.S.C. 10135 note (Supp. IV 2004)).

[18] Section 114(b) of NWPA directs the Secretary of Energy to submit a construction authorization application to NRC within 90 days of the date the site designation becomes effective. 42 U.S.C. 10134(b).

DOE submitted the application to NRC and on September 8, 2008, NRC Staff notified DOE that it found the application acceptable for docketing (73 FR 53284; September 15, 2008). Although the licensing proceeding for the YM repository is ongoing, DOE and the Administration have made it clear that they do not support construction of Yucca Mountain. The President's 2010 budget proposal states that the "Administration proposes to eliminate the Yucca Mountain repository program." *Terminations, Reductions, and Savings: Budget of the U.S. Government, Fiscal Year 2010, 68 available at: http://www.whitehouse.gov/omb/budget/fy2010/assets/trs.pdf*. (last visited on May 18, 2009) [hereinafter *2010 Budget*]. Given this statement it is possible that the Yucca Mountain repository will not be built, whether or not the Commission eventually authorizes construction. The Administration has, however, stated an intent to continue with the NRC licensing proceeding, and any experience gained by this process will aid DOE and the Commission in any future high-level waste repository licensing proceeding. *2010 Budget* at 68.

In 2005, the State of Nevada filed a petition for rulemaking with NRC (PRM-51-8) that raised the question whether continued use of the 2025 date, in effect, indicated prejudgment of the outcome of any licensing proceeding that might be held. The Commission rejected this notion in its denial of the petition:

> Even if DOE's estimate as to when it will tender a license application should slip further, the 2025 date would still allow for unforeseen delays in characterization and licensing. It also must be recognized that the Commission remains committed to a fair and comprehensive adjudication and, as a result, there is the potential for the Commission to deny a license for the Yucca Mountain site based on the record established in the adjudicatory proceeding. That commitment is not jeopardized by the 2025 date for repository availability. The Commission did not see any threat to its ability to be an impartial adjudicator in 1990 when it selected the 2025 date even though then, as now, a repository could only become available if the Commission's decision is favorable. Should the Commission's decision be unfavorable and should DOE abandon the site, the Commission would need to reevaluate the 2025 availability date, as well as other findings made in 1990.

*State of Nevada; Denial of a Petition for Rulemaking (*70 FR 48329, 48333; August 17, 2005); *affirmed, Nevada v. NRC,* No. 05-1350 (D.C. Cir., Sept. 22, 2006).

In the absence of an unfavorable NRC decision or DOE's abandonment of the site, the Commission found no reason to reopen its Waste Confidence findings. And now that the YM project appears unlikely to be constructed, the Commission would have adequate reasons to reopen the decision. But the Commission decided to revisit its decision before the Administration proposed to eliminate the project. The initial decision to revisit the Waste Confidence decision was supported by the recommendations of the Combined License Review Task Force Report. In its June 22, 2007, Staff Requirements Memorandum (SRM) on that report, the Commission approved rulemaking to resolve generic issues associated with combined license applications. SRM – COMDEK-07-0001/COMJSM-07-0001 – Report of the Combined License Review Task Force (ML071760109). In a subsequent SRM, issued on September 7, 2007, the Commission expressed the view that a near-term update to the Waste Confidence findings was appropriate. SRM – Periodic Briefing on New Reactor Issues (ML072530192). The staff, in its response to these SRMs, recognized that there would likely be long-term inefficiencies in combined license application proceedings due to the need to respond to potential questions and petitions directed to the existing Waste Confidence Decision and committed to evaluate possible updates to the decision.[19] *See* Memorandum from Luis A.

[19] Challenges to 10 CFR 51.23 in individual COL proceedings would likely be addressed through application of 10 CFR 2.335, "Consideration of Commission rules and regulations in adjudicatory proceedings." This rule generally prohibits attacks on NRC rules during adjudicatory proceedings but does allow a party to an adjudicatory proceeding to petition that application of a specified rule be waived or an exception made for the particular proceeding. 10 CFR 2.335(b). The sole ground for such a waiver or exception is that "special circumstances with respect to the subject matter of the particular proceeding are such that the application of the rule or regulation … would not serve the purposes for which the rule or regulation was adopted." *Id.* Thus, a review of the Waste (continued. . .)

Reyes to the Commissioners, "Rulemakings that Will Provide the Greatest Efficiencies to Complete the Combined License Application Reviews in a Timely Manner," December 17, 2007, at 3 (ML073390094). Based upon these and more recent developments, undertaking a public rulemaking proceeding now to consider revisions to the Waste Confidence findings and rule is appropriate and has allowed sufficient time to conduct a studied and orderly reassessment and to revise and update the findings and rule. In particular, the Commission has been able to consider alternative timeframes that would provide reasonable assurance for the availability of a repository. Further, the Commission does not believe that any of the developments since it issued its proposed update and proposed rule require it to revise any of its proposed findings. The proposed findings assumed that Yucca Mountain would not be built and that DOE would have to select a new repository site. The proposal to eliminate the Yucca Mountain project simply reinforces the appropriateness of revisiting the 1990 decision at this time.

In response to these recent developments, the Senate is considering a bill to appoint a National Commission on High-Level Radioactive Waste and Spent Nuclear Fuel. National Commission on High-Level Radioactive Waste and Spent Nuclear Fuel Establishment Act of 2009, S. 591, 111th Congress (1st Sess. 2009). The Department of Energy is also considering the appointment of a similar panel. "Obama budget seeks end to Yucca nuclear waste dump," http://www.reuters.com/article/idUSTRE5464TM20090507, (last visited on June 1, 2009). Based upon these developments, it appears likely that an expert panel will convene to assess the current options for dealing with the long-term disposal or storage of SNF and HLW. The Commission believes that there are four scenarios that are likely to be considered by such a

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Confidence findings and rule now might be expected to obviate such challenges in individual COL proceedings.

panel: 1) storage and disposal of HLW and SNF at a new repository; 2) a domestic reprocessing program with the resulting HLW stored at a new repository; 3) centralized interim storage; and 4) long-term onsite storage of SNF and HLW. Because of the decades of scientific studies supporting the use of a repository for the disposal of HLW and SNF, the Commission believes that any expert panel is likely to conclude that disposal of HLW and SNF in a repository remains the preferred course of action. Further, the NWPA still mandates a national repository program, and until the law is changed disposal in a repository remains the controlling policy. But if the panel were to recommend option 4 or some other option that does not involve eventual disposal of waste in a repository and the Congress were to amend the NWPA to change the national policy, then the Commission would likely have to revisit the Waste Confidence Findings.

One possible approach to revising Finding 2 might be to set the expected availability of a new repository at a time around 25 years after the conclusion of the YM licensing process in accordance with DOE's 1990 estimate of the time it would take to make a repository available at a different site. But the Commission rejected such an approach in the denial of the Nevada petition:

> [T]he use of a Commission acceptability finding as the basis for repository availability is impossible to implement because it would require the Commission to prejudge the acceptability of any alternative to Yucca Mountain in order to establish a reasonably supported outer date for the Waste Confidence finding. That is, if the Commission were to assume that a license for the Yucca Mountain site might be denied in 2015 and establish a date 25 years hence for the "availability" of an alternative repository (i.e., 2040), it would still need to presume the "acceptability" of the alternate site to meet that date (70 FR 48333; August 17, 2005).

Another approach would be to revise the finding to include a target date or timeframe for which it now seems reasonable to assume that a repository would be available. A target date for

when a disposal facility can reasonably be expected to be available would result from an examination of the technical and institutional issues that would need to be resolved before a repository could be available. The target date approach would be consistent with the HLW disposal programs in other countries, as explained below. A target date is admittedly not very different from "the first quarter of the twenty-first century" as stated in the current finding, but this approach makes it more clear that specification of a particular time for when a repository could be built does not imply that radioactive waste would pose unsafe conditions if a repository were not available at that time. The capability to safely store radioactive waste over long periods is a viable interim alternative not dependent on any one specific year for the availability of a repository. The Commission has adopted this approach in updating this finding.

Most countries possessing HLW and SNF eventually plan to confine these wastes using deep geologic disposal. Currently, there are 24 other countries considering disposal of spent or reprocessed nuclear fuel in deep geologic repositories. From the vantage point of near-term safety, there has been little urgency in these countries for implementing disposal facilities because of the perceived high degree of safety provided by interim storage, either at reactors or at independent storage facilities. Of these 24 countries, 10 have established target dates for the availability of a repository. Most of the 14 countries that have not established target dates rely on centralized interim storage, which may include a protracted period of onsite storage before shipment to a centralized facility.[20]

[20] The three countries with target dates that plan direct disposal of SNF are: Czech Republic (2050), Finland (2020), and Sweden (2020). The seven countries with target dates that plan disposal of reprocessed SNF/HLW are: Belgium (2035), China (2050), France (2025), Germany (2025), Japan (2030s), Netherlands (2013), Switzerland (2042).

The “target date” approach assumes a beginning date for a new repository program. NRC believes that it is reasonable to select 2025 as the starting point. The selection of 2025 allows time for the proposed “blue-ribbon panel” (or any other panel or commission) to consider HLW disposal issues and to make its recommendations; for the Administration and Congress to consider the recommendations; and for Congress to make any necessary changes to the NWPA, including expanding the project beyond YM and deciding whether a second repository is necessary or whether the capacity of the first repository should be expanded. *See S. 591, 111th Congress (1st Sess. 2009)*, The Report to the President and the Congress by the Secretary of Energy on the Need for a Second Repository, 1, (2008) available at http://www.ocrwm.doe.gov/uploads/1/Second_Repository_Rpt_120908.pdf. (last visited on May 22, 2009). While DOE or another organization may well have begun a new repository program before 2025, to be conservative, the Commission will use 2025 as the starting date for a new repository program. In sum, the Commission is removing its expectation that a repository will be available by 2025 and is updating the finding to describe a target date for the availability of a repository.

Assuming that a new repository program has begun by the year 2025, then setting a target date for the availability of a repository becomes a matter of examining the technical and institutional problems DOE would need to resolve to achieve the target date. The technical problems should be the same as those examined in the earlier Waste Confidence reviews, namely, how long it would take DOE to locate a suitable site and how long it would take to develop a waste package and engineered barriers for that site. For the reasons explained in our evaluation of Finding 1, the Commission continues to have reasonable assurance that disposal in a geologic repository is technically feasible. That is the approach being taken in all the countries identified previously that have set target dates for the availability of a repository. It is

also the approach of the 14 other countries that have HLW disposal programs but have not set target dates.[21] In addition, when Congress amended NWPA in 1987 to focus exclusively on the YM site, it did so for budgetary reasons and not because the other sites DOE was considering were discovered to be technically unacceptable. The research being done nationally and internationally strongly suggests that potentially acceptable sites exist and can be identified.

The amount of time DOE might need to develop an alternative repository site would depend upon the context of any enabling legislation, budgetary constraints, and the degree of similarity between a candidate site and other well-characterized sites with similar HLW disposal concepts. DOE began characterization of the YM site in 1982, made its suitability determination in 2002, and submitted a license application in 2008. But the history of potential repository development at YM may be a poor indicator of the amount of time needed to develop a new repository. Many problems extraneous to site characterization activities adversely affected DOE's repository program, such as changes in enabling legislation, public confidence issues, funding, and a significant delay in issuing environmental standards. In terms of the technical work alone, much would depend on whether Congress establishes a program involving characterization of many sites preliminary to the recommendation of a single site (similar to the 1982 NWPA) or a program focused on a single site (similar to the amended NWPA). The former would likely take longer but might have a better chance of success if problems develop with a single site. And the time needed to characterize the sites would also depend on whether the one or more sites chosen for characterization are similar to sites in this or other countries, which would allow DOE to use already existing knowledge and research to increase the efficiency of its repository

[21] These countries are: Brazil, Canada, Hungary, Lithuania, Romania, South Korea, Slovak Republic, Spain (direct disposal of SNF); Bulgaria, India, Italy, Russia, United Kingdom, Ukraine (disposal of reprocessed SNF/HLW).

program. Alternatively, the sites could present novel challenges for which much fundamental knowledge would have to be developed, which would require more time than sites that are similar to those that have already been studied. There are also many "lessons learned" from the YM repository program that could help to shorten the length of a new program. For example, performance assessment techniques have improved significantly over the past 20 years (*e.g.*, the Goldsim software package of DOE's Total System Performance Assessment that replaced the original FORTRAN based software) such that performance assessment models are easier to develop and more reliable than those that were available 20 years ago. Similarly, operational and manufacturing techniques developed during the YM program (*e.g.*, manufacturing of waste packages, excavation of drifts, waste handling), would be applicable to another program. Also, regulatory issues considered during the YM program (*e.g.*, burn-up credit for nuclear fuel and seismic performance analysis) should provide useful information for setting new standards or revising current standards.[22] Finally, the experience gained by completing the NRC licensing process, if that were to occur, should help DOE and NRC improve the licensing process for any repositories that follow.

Whether waste package and engineered barrier information developed during the YM repository program would be transferable to a new program depends heavily on the degree of similarity between an alternative site and YM. The fundamental physical characteristics of Yucca Mountain are significantly different from other potential repository sites that were considered in the U.S. repository program before 1987. DOE could select an alternative candidate site that was similar to YM in important physical characteristics (such as oxidizing

[22] Both NRC's Part 63 and EPA's Part 197 are applicable only for a repository at YM. NRC and EPA have in place standards for a repository at a different site, but these standards would likely be revised in a new repository program.

conditions, drifts above the water table with low amounts of water infiltration, water chemistry buffered by volcanic tuff rocks). In this instance, much of the existing knowledge for engineered barrier performance at YM might be transferable to a different site. Nevertheless, much of DOE's current research on engineered barriers for YM could be inapplicable if an alternative site had significantly different characteristics than the YM site, such as an emplacement horizon in reducing conditions below the water table. In this instance, research from other DOE, industry, or international programs might provide important information on engineered barriers, provided the new site is analogous to sites and engineered barriers being considered elsewhere.

It is important to note, however, that broader institutional issues have emerged since 1990 that bear on the time it takes to implement geologic disposal. International developments have made it clear that technical experience and confidence in geologic disposal, on their own, are not sufficient to bring about the broad social and political acceptance needed to construct a repository.

In 1997, the United Kingdom rejected an application for the construction of a rock characterization facility at Sellafield, leaving the country without a path forward for long-term management or disposal of either intermediate-level waste or SNF. In 1998, an inquiry by the UK House of Lords endorsed geologic disposal but specified that public acceptance was required. As a result, the UK Government embraced a repository plan based on the principles of voluntarism and partnership between communities and implementers. This led to the initiation of a national public consultation, and major structural reorganization within the UK program. In 2007, the Scottish Government officially rejected any further consultation with the UK Government on deep geologic disposal of HLW and SNF. This action by the Scottish

Government effectively ends more than 7 years of consultations with stakeholders near Scottish nuclear installations and represents another major setback for the UK program.

In Germany, a large salt dome at Gorleben has been under study since 1977 as a potential SNF repository. After decades of intense discussions and protests, the utilities and the government reached an agreement in 2000 to suspend exploration of Gorleben for at least three, and at most ten, years. In 2003, the Federal Ministry for the Environment set up an interdisciplinary expert group to identify, with public participation, criteria for selecting new candidate sites.

Initial efforts in France, during the 1980s, also failed to identify potential repository sites, using solely technical criteria. Failure of these attempts led to the passage of nuclear waste legislation that prescribed a period of 15 years of research. Reports on generic disposal options in clay and granite media were prepared and reviewed by the safety authorities in 2005. In 2006, conclusions from the public debate on disposal options, held in 2005, were published. Later that year, the French Parliament passed new legislation designating a single site for deep geologic disposal of intermediate and HLW. This facility, to be located in the Bure region of northeastern France, is scheduled to open in 2025, some 34 years after passage of the original Nuclear Waste Law of 1991.

In Switzerland, after detailed site investigations in several locations, the Swiss National Cooperative for Radioactive Waste Disposal proposed, in 1993, a deep geologic repository for low- and intermediate-level waste at Wellenberg. Despite a 1998 finding by Swiss authorities that technical feasibility of the disposal concept was successfully demonstrated, a public cantonal referendum rejected the proposed repository in 2002. Even after more than 25 years of

high quality field and laboratory research, Swiss authorities do not expect a deep geologic repository will be available before 2040.

In 1998, an independent panel reported to the Governments of Canada and Ontario on its review of Atomic Energy of Canada Ltd.'s concept of geologic disposal. Canadian Nuclear Fuel Waste Disposal Concept Environmental Assessment Panel, *Report of the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment* Panel, February 1998. The panel found that from a technical perspective, safety of the concept had been adequately demonstrated, but from a social perspective, it had not. The panel concluded that broad public support is necessary in Canada to ensure the acceptability of a concept for managing nuclear fuel wastes. The panel also found that technical safety is a key part, but only one part, of acceptability. To be considered acceptable in Canada, the panel found that a concept for managing nuclear fuel wastes must: (1) have broad public support; (2) be safe from both a technical and social perspective; (3) have been developed within a sound ethical and social assessment framework; (4) have the support of Aboriginal people; (5) be selected after comparison with the risks, costs, and benefits of other options; and (6) be advanced by a stable and trustworthy proponent and overseen by a trustworthy regulator. Resulting legislation mandated a nationwide consultation process and widespread organizational reform. Eight years later, in 2005, a newly-created Nuclear Waste Management Organization (NWMO), recommended an Adaptive Phased Management approach for long-term care of Canada's SNF, based on the outcomes of the public consultation. This approach includes both a technical method and a new management system. According to NWMO, it "provides for centralized containment and isolation of used nuclear fuel deep underground in suitable rock formations, with continuous monitoring and opportunity for retrievability; and it allows sequential and collaborative decision-making, providing the flexibility to adapt to experience and societal and

technological change." NWMO, *Choosing a Way Forward: The Future Management of Canada's Used Nuclear Fuel, Final Study Report*, November 2005.

In 2007, the Government of Canada announced its selection of the Adaptive Phased Management approach and directed NWMO to take at least two years to develop a "collaborative community-driven site-selection process." NWMO will use this process to open consultations with citizens, communities, Aboriginals, and other interested parties to find a suitable site in a willing host community. The Canadian Government explicitly acknowledges that this approach will "take time to develop a process that is open, transparent, inclusive, and that is built on a solid foundation of trust, integrity and respect for Canadians and the environment." The Honorable Gary Lunn, P.C., M.P., Minister of Natural Resources, Canada, to President of NWMO, July 12, 2007. For financial planning and cost estimation purposes only, NWMO assumes the availability of a deep geological repository in 2035, 27 years after initiating development of new site selection criteria, 30 years after embarking on a national public consultation, and 37 years after rejection of the original geologic disposal concept. NWMO, *Annual Report 2007: Moving Forward Together*, March 2008.

Repository development programs in Finland and Sweden are further along than in other countries but have nonetheless taken the time to build support from potential host communities. In Finland, preliminary site investigations started in 1986, and detailed characterizations of four locations were performed between 1993 and 2000. In 2001, the Finnish Parliament ratified the Government's decision to proceed with a repository project at a chosen site only after the 1999 approval by the municipal council of the host community. Finland expects this facility to begin receipt of SNF for disposal in 2020, 34 years after the start of preliminary site investigations.

Between 1993 and 2000, Sweden conducted feasibility studies in eight municipalities. Based on technical considerations, one site was found unsuitable for further study, and two sites, based on municipal referenda, decided against allowing further investigations. Three of the remaining five sites were selected for detailed site investigations. Municipalities adjacent to two of these sites agreed to be potential hosts and one refused.

On June 3, 2009, the Swedish Nuclear Fuel and Waste Management Company, SKB, selected a site near Oesthammer as the site for the final repository for disposal of Swedish spent nuclear fuel. Since 2007, detailed site investigations were conducted at both Oesthammer and Oskarshamn, both of which already host nuclear power stations. All Swedish spent fuel will be disposed in the Oesthammer repository. It will be located at a depth of 500 meters, in crystalline bedrock which is relatively dry with few fractures. SKB plans to submit a license application in 2010, along with an Environmental Impact Assessment and safety analysis. A government decision is expected in 2013. If Swedish authorities authorize construction, the repository would be available for disposal around 2023, some 30 years after feasibility studies began.

Before DOE can start the development of a new site, Congress will need to provide direction for the long-term management and disposal of SNF and HLW. Whatever approach Congress mandates, international experience since 1990 would appear to suggest that greater attention may need to be paid to developing societal and political acceptance in concert with essential technical, safety, and security assurances. While there is no technical basis for making precise estimates of the minimum time needed to accomplish these objectives, examination of the international examples cited previously would support a range of between 25 and 35 years.

Another important institutional issue is whether funding for a new repository program is likely to be available. The provisions of NWPA for funding the repository have proved to be adequate for the timely development of a repository in the sense that there have always been more than sufficient funds available for meeting the level of funding Congress appropriates for the repository program. Section 302(e)(2) of NWPA provides that the Secretary of Energy may make expenditures from the Nuclear Waste Fund (NWF), subject to appropriations by the Congress. At the FY 2009 Appropriations Hearing (April 10, 2008), Edward F. Sproat III, former Director of DOE's OCRWM, stated that the NWF has a balance of approximately $21.0 billion. Thus, the NWF has the capacity to ensure timely development of a repository consistent with Congressional funding constraints. Moreover, DOE has prepared updated contracts and a number of utility companies have signed contracts with the department. Therefore, there will be a source of funding for disposal of the fuel to be generated by these reactors.

Arriving at a target date involves considering the technical and institutional factors discussed previously. It appears that the technical work needed to make a repository available could be done in less time than it took DOE to submit a license application for the YM site (26 years measured from the beginning of site characterization). But as discussed previously, the time needed to develop societal and political acceptance of a repository might range between 25 and 35 years. Therefore, if the starting point for a new program were 2025, a reasonable target date would be 2050-2060 for the availability of a repository.

Finding 2 also predicts that sufficient repository capacity will be available within 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of any reactor to dispose of HLW and SNF originating in such reactor and generated up to that time. As explained previously, in 1990 DOE projected that 87,000 MTHM would be

generated by the year 2036. Given the statutory limit of 70,000 MTHM for the first repository, either statutory relief from that limit or a second repository would be needed. The Commission's continued assurance that sufficient repository capacity would be available within 30 years of license expiration of all reactors rested on an assumption that two repositories would be available in approximately 2025 and 2035, each with acceptance rates of 3400 MTHM/year within several years after commencement of operations. *See* 55 FR 38502; September 18, 1990. And DOE acknowledged that a second repository, or an expansion of the statutory disposal limit for a single repository, would be necessary to accommodate all the spent fuel from the currently operating and future reactors. The Report to the President and the Congress by the Secretary of Energy on the need for a second repository, 1, (2008) available at http://www.ocrwm.doe.gov/uploads/1/Second_Repository_Rpt_120908.pdf (last visited May 22, 2009).

A target date of 2050-2060 calls into question the current finding that sufficient repository space will be available within 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license).[23] According to the Nuclear Energy Institute, there are 16 reactor operating licenses that will expire between 2012 and 2020 and an additional 41 licenses that will expire between 2021 and 2030. NEI, Resources & Stats, http://www.nei.org/resourcesandstats/graphicsandcharts/licenseinformation (last visited May 22, 2009). Many of these licenses may be renewed, which would extend their operating lifetimes,

[23] Based on the inventory of SNF in nuclear power plant pools and interim storage facilities, the amount of spent fuel is anticipated to exceed the 70,000 MTHM disposal limit in the NWPA by 2010. *See The Report to the President and the Congress by the Secretary of Energy on the Need for a Second Repository,* DOE/RW-0595, December 2008. Therefore, a new repository program would need to remove this limit or provide for more than one repository.

but this cannot be assumed.[24] For licenses that are not renewed, some spent fuel will need to be stored for more than 30 years beyond the expiration of the license if a repository is not available until 2050-2060. According to Appendix B of NUREG-1350, "Information Digest, 2008–2009," there are 22 reactors that were licensed to operate and have been permanently shut down. Thirty years beyond their licensed life of operation will come as early as 2029 for Dresden 1 and as late as 2056 for Millstone 1, but for most of these plants, 30 years beyond the licensed life for operation will occur in the 2030s and 2040s. Thus, for virtually all of these plants, spent fuel will have to be stored beyond 30 years after the expiration of the license if a repository is not available until 2050-2060.

In 1990, the Commission emphasized that this 30 year period was not a safety finding. It was only an estimate of how long it was likely that SNF would need to be stored given the Commission's confidence that repository disposal would be available by 2025. In fact, the Commission said it was not concerned about the fact that it was already clear in 1990 that a few reactors would need to store spent fuel on-site beyond 30 years after the effective expiration date of their licenses (*i.e.*, the date the license prematurely terminated) due to its confidence in the safety of spent fuel storage. (55 FR 38503; September 18, 1990). For the reasons presented in the evaluation of Finding 4, the Commission is now able to say that there is no public health and safety or environmental concern if its target date of 2050-2060 for the availability of a disposal facility results in the need to store fuel at some reactors for 50-60 years after expiration of the license or even longer.

[24] Seven of the licenses that will expire between 2021 and 2030 are renewed licenses (Dresden 2, Ginna, Nine Mile Point 1, Robinson 2, Point Beach 1, Monticello, and Oyster Creek). Forty-five other reactor operating licenses have been renewed and the renewed licenses will expire after 2030.

If the Commission had not already issued a proposed rule and update to the Waste Confidence decision, then the Administration's proposed budget and plan to terminate the YM project would likely have forced it to do so. The Commission's proposed update to the Waste Confidence decision, although it could not consider these recent developments, did assume that YM would not be built and that DOE would have to search for another repository location, which now appears to be the case. The Commission, therefore, finds nothing in recent developments that would cause it to reconsider its proposed Finding 2. Based on the above information and consideration of the public comments, the Commission revises Finding 2 to eliminate its expectation that a repository will be available within the first quarter of the twenty-first century and to state that a repository may reasonably be expected to be available within 50-60 years beyond the licensed life for operation of any reactor, which is based on its projected target date of 2050-2060 for the availability of a repository.

C. Finding 2.

The Commission finds reasonable assurance that sufficient mined geologic repository capacity will be available within 50-60 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of any reactor to dispose of the commercial HLW and spent fuel originating in such reactor and generated up to that time.

III. Finding 3: The Commission finds reasonable assurance that HLW and spent fuel will be managed in a safe manner until sufficient repository capacity is available to assure the safe disposal of all HLW and spent fuel.

A. Bases for Finding 3.

The Commission reached this finding in 1984 and reaffirmed it in 1990. The focus of this finding is on whether reactor licensees can be expected to safely store their spent fuel in the period between the cessation of reactor operations and the availability of repository capacity for their fuel. The Commission found that the spent fuel would be managed safely because, under either a possession-only Part 50 license or a Part 72 license, the utility would remain under NRC's regulatory control and inspections and oversight of storage facilities would continue. (49 FR 34679-34680; August 31, 1984, 55 FR 38508; September 18, 1990). In 1990, when extended storage at the reactor site seemed more probable, the Commission noted that Part 72 allowed for license renewals and that NRC was considering issuance of a general Part 72 license under which spent fuel could be stored in NRC-certified casks.[25] (55 FR 38508; September 18, 1990). The Commission reasoned that these regulations would provide additional NRC supervision of spent fuel management. The Commission was not concerned about then-looming contractual disputes between DOE and the utilities over DOE's inability to remove spent fuel from reactor sites in 1998 because NRC licensees cannot abandon, and remain responsible for, spent fuel in their possession. (55 FR 38508; September 18, 1990).

[25] Part 72 was, in fact, amended to provide for storage of spent fuel in NRC-certified casks pursuant to a general license. (55 FR 29191; July 18, 1990).

The Commission also considered the unusual case where a utility was unable to manage its spent fuel. If a utility were to become insolvent, the Commission believes that the cognizant state public utility commission would require an orderly transfer to another entity, which could be accomplished if the new entity met NRC's regulations. (49 FR 34680; August 31, 1984). Further, the Commission expressed the view that, while the possibility of a need for Federal action to take over stored spent fuel from a defunct utility or from a utility that lacked technical competence to assure safe storage was remote, the authority for this type of action exists in sections 186c and 188 of the Atomic Energy Act. *Id*.

B. Evaluation of Finding 3.

As explained above, the focus of Finding 3 is on whether reactor licensees can be expected to safely store their spent fuel in the period between the cessation of reactor operations and the availability of repository capacity for their fuel. In this regard, the NRC is successfully regulating four decommissioned reactor sites that continue to hold Part 50 licenses and consist only of an ISFSI under the Part 72 general license provisions.[26] In addition, the NRC staff has discussed plans to build and operate ISFSIs under the Part 72 general license provisions with the licensees at the La Crosse and Zion plants, which are currently undergoing decommissioning. The La Crosse plant plans to load its ISFSI in August 2010 and the Zion plant is still discussing its plans with the NRC staff. The NRC is also successfully regulating ISFSIs at two fully decommissioned reactor sites (Trojan and Ft. St. Vrain) under Part 72 specific licenses.[27]

[26] These reactor sites include Maine Yankee, Yankee Rowe, Connecticut Yankee (also known as Haddam Neck), and Big Rock Point.

[27] There are several additional sites with specific Part 72 ISFSI licenses that are in the process of decommissioning (*e.g.*, Humbolt Bay, Rancho Seco).

The NRC monitors the performance of ISFSIs at decommissioned reactor sites by conducting periodic inspections that are identical to ISFSI inspections at operating reactor sites. When conducting inspections at these ISFSIs, NRC inspectors follow the guidance in NRC Inspection Manual Chapter 2690, “Inspection Program for Dry Storage of Spent Reactor Fuel at Independent Spent Fuel Storage Installations and for Part 71 Transportation Packages.” At all six decommissioned reactor sites mentioned previously, all spent fuel on site has been successfully loaded into the ISFSI, so only those inspection procedures applicable to the existing storage configurations are conducted. Also, any generally licensed ISFSI where decommissioning and final survey activities related to reactor operations have been completed is treated as an “away from reactor” (AFR) ISFSI for inspection purposes. Therefore, those programs relied upon under the 10 CFR Part 50 license for operation of the generally licensed ISFSI are also subject to inspection.

The NRC has not encountered any management problems associated with the ISFSIs at these six decommissioned reactor sites. Further, NRC’s inspection findings have not found any unique management problems at any currently operating ISFSI. Generally, the types of issues identified through NRC inspections of ISFSIs are similar to issues identified for Part 50 licensees. Most issues are identified early in the operational phase of the dry cask storage process, during loading preparations and actual spent fuel loading activities. Once a loaded storage cask is placed on the storage pad, relatively few inspection issues are identified due to the passive nature of these facilities.

Further, NRC’s regulations require that every nuclear power reactor operating license issued under 10 CFR Part 50 and every COL issued under 10 CFR Part 52 must contain a

condition requiring licensees to submit written notification to the Commission of the licensees' plan for managing irradiated fuel between cessation of reactor operation and the time the DOE takes title to and possession of the irradiated fuel for ultimate disposal in a repository. The submittal, required by 10 CFR 50.54(bb), must include information on how the licensee intends to provide funding for the management of its irradiated fuel. Specifically, 10 CFR 50.54(bb) requires the licensee to:

> [W]ithin 2 years following permanent cessation of operation of the reactor or 5 years before expiration of the reactor operating license, whichever occurs first, submit written notification to the Commission for its review and preliminary approval of the program by which the licensee intends to manage and provide funding for the management of all irradiated fuel at the reactor following permanent cessation of operation of the reactor until title to the irradiated fuel and possession of the fuel is transferred to the Secretary of Energy for its ultimate disposal…. Final Commission review will be undertaken as part of any proceeding for continued licensing under part 50 or 72 of this chapter. The licensee must demonstrate to NRC that the elected actions will be consistent with NRC requirements for licensed possession of irradiated nuclear fuel and that the actions will be implemented on a timely basis. Where implementation of such actions requires NRC authorizations, the licensee shall verify in the notification that submittals for such actions have been or will be made to NRC and shall identify them. A copy of the notification shall be retained by the licensee as a record until expiration of the reactor operating license. The licensee shall notify the NRC of any significant changes in the proposed waste management program as described in the initial notification.

To date, the NRC has also renewed four specific Part 72 ISFSI licenses. These renewals include the Part 72 specific licenses for the General Electric Morris Operation (the only wet, or pool-type ISFSI), as well as the Surry, H.B. Robinson, and Oconee ISFSIs. The NRC staff also anticipates a renewal application for the Fort St. Vrain ISFSI sometime in 2009. Specific licenses for six additional ISFSIs will expire between 2012 and 2020. It is expected that license renewal will be requested by these licensees, unless a permanent repository or some other interim storage option is made available. Although the NRC staff's experience with renewal of ISFSI licenses is limited to these four cases, it is noteworthy that the Surry, H.B. Robinson and

Oconee ISFSI licenses were renewed for a period of 40 years, instead of the 20-year renewal period currently provided for under Part 72. The Commission authorized the staff to grant exemptions to allow the 40-year renewal period after the staff reviewed the applicants' evaluations of aging effects on the structures, systems, and components important to safety. The Commission determined that the evaluations, supplemented by the licensees' aging management programs, provide reasonable assurance of continued safe storage of spent fuel in these ISFSIs. *See* SECY-04-0175, "Options for Addressing the Surry Independent Spent Fuel Storage Installation License-Renewal Period Exemption Request," September 28, 2004 (ML041830697).

With regard to generally licensed ISFSIs, the NRC staff is currently working on a proposed rulemaking to clarify the processes for the renewal of ISFSIs operated under the general license provisions of 10 CFR Part 72 and for renewal of the Certificates of Compliance for dry cask storage systems. *See License and Certificate of Compliance Terms* (73 FR 45173; August 4, 2008). There are currently nine sites operating generally licensed ISFSIs that will reach the prescribed 20 year limit on storage between 2013 and 2020.

The Commission concludes that the events that have occurred since the last formal review of the Waste Confidence Decision in 1990 support a continued finding of reasonable assurance that HLW and spent fuel will be managed in a safe manner until sufficient repository capacity is available. Specifically, the NRC has continued its regulatory control and oversight of spent fuel storage at both operating and decommissioned reactor sites, through both specific and general Part 72 licenses. With regard to general Part 72 licenses, the NRC has successfully implemented a general licensing and cask-certification program, as envisioned by the Commission in 1990. There are currently 16 certified spent fuel storage cask designs. 10 CFR

72.214 (2009). In addition, the Commission's reliance on the license renewal process in its 1990 review has proven well-placed, with three specific Part 72 ISFSI licenses having been successfully renewed for an extended 40-year renewal period, and a fourth having been renewed for a period of 20 years. Further, while DOE did not meet its contractual obligation to begin removing spent fuel from reactor sites in 1998, NRC licensees have continued to meet their obligation to safely store spent fuel in accordance with the requirements of 10 CFR Parts 50 and 72.[28]

Based on the above discussion, including its response to the public comments, the Commission reaffirms Finding 3

[28] Section 302 of NWPA authorizes the Secretary of Energy to enter into contracts with utilities generating HLW and SNF under which the utilities are to pay statutorily imposed fees into the NWF in return for which the Secretary, "beginning not later than January 31, 1998, will dispose of the [HLW] or [SNF] involved …." 42 U.S.C. 10222(a)(5)(B). The NWPA also prohibits NRC from issuing or renewing a reactor operating license unless the prospective licensee has entered into a contract with DOE or is engaged in good-faith negotiations for such a contract. 42 U.S.C. 10222(b)(1). When it became evident that a repository would not be available in 1998, DOE took the position that it did not have an unconditional obligation to accept the HLW or SNF in the absence of a repository. *See Final Interpretation of Nuclear Waste Acceptance Issues*, (60 FR 21793; April 28, 1995). The U.S. Court of Appeals for the District of Columbia Circuit, however, held that DOE's statutory and contractual obligation to accept the waste no later than January 31, 1998, was unconditional. *Indiana Michigan Power Co. v. DOE,* 88 F.3d 1272 (D.C. Cir. 1996). Subsequently, the utilities have continued to safely manage the storage of SNF in reactor storage pools and in ISFSIs and have received damage awards as determined in lawsuits brought before the U.S. Federal Claims Court. *See, e.g., System Fuels Inc. v. U.S.,* 78 Fed. Cl. 769 (October 11, 2007).

IV. Finding 4 (1990): The Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations.

A. Bases for Finding 4.

This finding focuses on the safety and environmental effects of long-term storage of spent fuel. In 1984, the Commission found that spent fuel can be stored safely and without significant environmental impacts for at least 30 years beyond the expiration of reactor operating licenses. (49 FR 34660; August 31, 1984). In 1990, the Commission determined that if the reactor operating license were renewed for 30 years,[29] storage would be safe and without environmental significance for at least 30 years beyond the term of licensed operation for a total of at least 100 years. (55 FR 38513; September 18, 1990). The Commission looked at four broad issues in making this finding: (1) the long-term integrity of spent fuel under water pool storage conditions, (2) the structure and component safety for extended facility operation for storage of spent fuel in water pools, (3) the safety of dry storage, and (4) the potential risks of accidents and acts of sabotage at spent fuel storage facilities. (49 FR 34681; August 31, 1984; 55 FR 38509; September 18, 1990).

[29] Subsequently, the Commission limited the renewal period for power reactor licenses to 20 years beyond expiration of the operating license or combined license. 10 CFR 54.31; (56 FR 64943, 64964; December, 13,1991).

With respect to the safety of water pool storage, the Commission found in 1984 that research and experience in the United States, Canada, and other countries confirmed that long-term storage could be safely undertaken. (49 FR 34681-34682; August 31, 1984). In 1990, the Commission determined that experience with water storage of spent fuel continued to confirm that pool storage is a benign environment for spent fuel that does not lead to significant degradation of spent fuel integrity and that the water pools in which the assemblies are stored will remain safe for extended periods. Further, degradation mechanisms are well understood and allow time for appropriate remedial action. (55 FR 38510, 38511; September 18, 1990). In sum, based on both experience and scientific studies, the Commission found wet storage to be a fully-developed technology with no associated major technical problems.

In 1984, the Commission based its confidence in the safety of dry storage on an understanding of the material degradation processes, derived largely from technical studies, together with the recognition that dry storage systems are simple and easy to maintain. (49 FR 34683-34684; August 31, 1984). By 1990, NRC and ISFSI licensees had considerable experience with dry storage. NRC staff safety reviews of topical reports on storage system designs, the licensing and inspection of dry storage at two reactor sites under Part 72, and NRC's promulgation of an amendment to Part 72 that incorporated a monitored retrievable storage installation (MRS) (a dry storage facility) into the regulations confirmed the 1984 conclusions on the safety of dry storage. In fact, under the environmental assessment for the amendment (NUREG-1092), the Commission found confidence in the safety and environmental insignificance of dry storage at an MRS for 70 years following a period of 70 years of storage in spent fuel storage pools. (55 FR 38509-38513; September 18, 1990).

The Commission also found that the risks of major accidents at spent fuel storage pools resulting in offsite consequences were remote because of the secure and stable character of the spent fuel in the storage pool environment and the absence of reactive phenomena—"driving forces"—that might result in dispersal of radioactive material. The Commission noted that storage pools and ISFSIs are designed to safely withstand accidents caused either by natural or man-made phenomena, and that, due to the absence of high temperature and pressure conditions, human error does not have the capability to create a major radiological hazard to the public. (49 FR 34684-34685; August 31, 1984). By 1990, the NRC staff had spent several years studying catastrophic loss of reactor spent fuel pool water possibly resulting in a fuel fire in a dry pool and concluded that, because of the large inherent safety margins in the design and construction of a spent fuel pool, no action was justified to further reduce the risk. (55 FR 38511; September 18, 1990).

In 1984, the Commission recognized that the intentional sabotage of a storage pool was theoretically possible but found that the consequences would be limited because, with the exception of some gaseous fission products, the radioactive content of spent fuel is in the form of solid ceramic material encapsulated in high-integrity metal cladding and stored underwater in a reinforced concrete structure. (49 FR 34685; August 31, 1984). Under these conditions, the Commission noted that the radioactive content of spent fuel is relatively resistant to dispersal to the environment. Similarly, because of the weight and size of the sealed protective enclosures, dry storage of spent fuel in dry wells, vaults, silos, and metal casks is also relatively resistant to sabotage and natural disasters. *Id*. Although the 1990 decision examined several studies of accident risk, no considerations affected the Commission's confidence that the possibility of a major accident or sabotage with offsite radiological impacts at a spent fuel storage facility is extremely remote. (55 FR 38512; September 18, 1990).

Finally, the Commission noted that the generation and onsite storage of more spent fuel as a result of reactor license renewals would not affect the Commission's findings on environmental impacts. Finding 4 is not based on a determination of a specific number of reactors and amount of spent fuel; Finding 4 evaluates the safety of spent fuel storage and lack of environmental impacts overall. Further, individual license renewal actions are subject to separate safety and environmental reviews. (55 FR 38512; September 18, 1990).

B. Evaluation of Finding 4.

As discussed above, Finding 4 focuses on the safety and environmental significance of long-term storage of spent fuel. Specifically, the Commission examined four broad issues in making this finding: (1) the long-term integrity of spent fuel under water pool storage conditions, (2) the structure and component safety for extended facility operation for storage of spent fuel in water pools, (3) the safety of dry storage, and (4) the potential risks of accidents and acts of sabotage at spent fuel storage facilities.

1. Storage in Spent Fuel Pools.

Since 1990, the NRC has continued its periodic examination of spent fuel pool storage to assure that adequate safety is maintained and that there are no adverse environmental effects from the storage of spent fuel in pools. The Office of Nuclear Reactor Regulation (NRR) and the former Office for Analysis and Evaluation of Operational Data (AEOD) independently evaluated the safety of spent fuel pool storage, and the results of these evaluations were documented in a memo to the Commission dated July 26, 1996, entitled "Resolution of Spent Fuel Storage Pool

Action Plan Issues," (ML003706364) and a separate memo to the Commission dated October 3, 1996, entitled, "Assessment of Spent Fuel Pool Cooling," (ML003706381) (later published as NUREG-1275, Vol. 12, "Operating Experience Feedback Report: Assessment of Spent Fuel Cooling," February 1997). As a result of these studies, the NRC staff and industry identified a number of follow-up activities that are described by the NRR staff in a memo to the Commission dated September 30, 1997, entitled, "Followup Activities on the Spent Fuel Pool Action Plan," (ML003706412). These evaluations became part of the investigation of Generic Safety Issue 173, "Spent Fuel Pool Storage Safety," which found that the relative risk posed by loss of spent fuel cooling is low when compared with the risk of events not involving the SFP.

The safety and environmental effects of spent fuel pool storage were also addressed in conjunction with regulatory assessments of permanently shutdown nuclear plants and decommissioning nuclear power plants. NUREG/CR-6451, "A Safety and Regulatory Assessment of Generic BWR and PWR Permanently Shutdown Nuclear Power Plants," (August 1997) addressed the appropriateness of regulations (*e.g.*, requirements for emergency planning and insurance) associated with spent fuel pool storage. The study identified a number of regulations that apply only to an operating reactor and not to spent fuel storage. These regulations are not needed to ensure the safe maintenance of a permanently shutdown plant. And the study also provided conservative bounding estimates of fuel coolability and offsite consequences for the most severe accidents that involve draining of the spent fuel pool.

More recently, the NRC issued NUREG-1738, "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants," (February 2001). This study provided the results of the NRC staff's latest evaluation of the accident risk in a spent fuel pool at

decommissioning plants. The report discussed fuel coolability for various types of accidents and included potential offsite consequences based on assumed radiation releases. The study demonstrated that by using conservative and bounding assumptions regarding the postulated accidents, the predicted risk estimates were below those associated with reactor accidents and well below the Commission's safety goal. There was even some concern within the NRC that the level of conservatism in the analysis accompanying NUREG-1738 overstated the likelihood and severity of the more extreme spent fuel pool accidents. These concerns about excessive conservatism have proven valid, as subsequent studies (described in the following paragraph) have conclusively and consistently shown that the safety margins are much greater than indicated by previous studies, such as NUREG-1738. *See The Attorney General of Commonwealth of Massachusetts, The Attorney General of California; Denial of Petitions for Rulemaking,* 73 FR 46204; August 8, 2008.

Following the terrorist attacks of September 11, 2001, the NRC undertook a complete reexamination of spent fuel pool safety and security issues. This reexamination included a significantly improved methodology, based on detailed state-of-the-art analytical modeling, for assessing the response of spent fuel assemblies during security events including those that might result in draining of the spent fuel pool. This more detailed and realistic analytical modeling was also supported by extensive testing of zirconium oxidation kinetics in an air environment and full scale coolability and "zirc fire" testing of spent fuel assemblies. This effort both confirmed the conservatism of past analyses and provided more realistic analyses of fuel coolability and potential responses during accident or security event conditions. Importantly, the new more detailed and realistic modeling led to the development of improvements in spent fuel safety, which were required to be implemented at spent fuel pools by the Commission for all operating reactor sites. *See id.*

In 2003, the U.S. Congress asked the National Academies to provide independent scientific and technical advice on the safety and security of commercial SNF storage, including the potential safety and security risks of SNF presently stored in cooling pools and dry casks at commercial nuclear reactor sites. In July 2004 the National Academies issued a classified report, and a publicly available unclassified summary was made available in 2005. As part of the information gathering for the study, the NRC and Sandia National Laboratories briefed the Academy authoring committee on the ongoing work to reassess spent fuel pool safety and security issues. The Academy report contains findings and recommendations for reducing the risk of events involving spent fuel pools as well as dry casks. Chairman Nils J. Diaz provided the Commission's response to the Academy in a letter to Senator Pete V. Domenici, dated March 14, 2005 (ML050280428). In essence, the NRC concluded, as a result of its own study and subsequent regulatory actions, that it had adopted the important recommendations of the Academy's report relevant to spent fuel pools. As a result of the improvements to spent fuel pool safety and security, and the inherent safety and robustness of spent fuel pool designs, the NRC concluded that the risk associated with security events at spent fuel pools is acceptably low. Because these safety improvements to spent fuel pool storage are applicable to non-security events (randomly initiated accidents), accident risk was also further reduced.

While the Commission continues to have reasonable assurance that storage in spent fuel pools provides adequate protection of public health and safety and the common defense and security, and will not result in significant impacts on the environment, NRC acknowledges several incidents of groundwater contamination originating from leakage in reactor spent fuel pools and associated structures. In 1990, the Commission specifically acknowledged two incidents where radioactive water leaked from spent fuel pools, one of which resulted in

contamination outside of the owner controlled area. *See* 55 FR. 38511; September 18, 1990. The Commission addressed these events stating, "[t]he occurrence of operational events like these have been addressed by NRC staff at the plants listed. The staff has taken inspection and enforcement actions to reduce the potential for such operational occurrences in the future." *Id*.

On March 10, 2006, the NRC Executive Director for Operations established the Liquid Radioactive Release Lessons Learned Task Force in response to incidents at several plants involving unplanned, unmonitored releases of radioactive liquids into the environment. Liquid Radioactive Release Lessons Learned Task Force Final Report, September 1, 2006 (Task Force Report) (ML062650312). One of the incidents that prompted formation of the Task Force involved leakage from the Unit 1 and 2 spent fuel pools at Indian Point.[30] Task Force Report, at 1, 5-6, 11. The Task Force reviewed historical data on inadvertent releases of radioactive liquids, including four additional incidents involving leakage from spent fuel pools (Seabrook, Salem, Watts Bar, and Palo Verde). As a result of its review, the Task Force concluded that "[b]ased on bounding dose calculations and/or actual measurements, the near-term public health impacts have been negligible for the events at NRC-licensed operating power facilities discussed in this report." Task Force Report, at 15. While concluding that near-term public health impacts were negligible, the Task Force made 26 specific recommendations for

[30] In May 2008, the NRC staff completed an inspection at Indian Point Units 1 and 2. NRC Inspection Report Nos. 05000003/2007010 and 05000247/2007010, May 13, 2008 (ML0813404250). The purpose of the inspection was to assess Entergy's site groundwater characterization conclusions and the radiological significance of Entergy's discovery of a spent fuel pool leakage at Units 1 and 2. The NRC staff concluded that Entergy's response to the spent fuel pool leakage was reasonable and technically sound. The NRC staff stated that "[t]he existence of on-site groundwater contamination, as well as the circumstances surrounding the causes of leakage and previous opportunities for identification and intervention, have been reviewed in detail. Our inspection determined that public health and safety has not been, nor is likely to be, adversely affected, and the dose consequence to the public that can be attributed to current on-site conditions associated with groundwater contamination is negligible." *Id.*

improvements to NRC's regulatory programs concerning unplanned or unmonitored releases of radioactive liquids from nuclear power reactors.

The NRC staff has addressed, or is in the process of addressing, the Task Force recommendations. *See* "Liquid Release Task Force Recommendations Implementation Status as of February 26, 2008" (ML073230982) (Implementation Status). Actions taken in response to Task Force recommendations included revisions to several guidance documents, development of draft regulatory guidance on implementation of the requirements of 10 CFR 20.1406 (i.e. DG-4012),[31] revisions to Inspection Procedure 71122.01, and an evaluation of whether further action was required to enhance the performance of SFP tell-tale drains.[32] For example, Regulatory Guide 4.1 is being revised to provide guidance to industry for detecting, evaluating, and monitoring releases from operating facilities via unmonitored pathways; to ensure consistency with current industry standards and commercially available radiation detection methodology; to clarify when a licensee's radiological effluent and environmental monitoring programs should be expanded based on data or environmental conditions; and to ensure that leaks and spills are detected before radionuclides migrate offsite via an unmonitored pathway. Also, Regulatory Guide 1.21 is being revised to provide a definition of "significant contamination" that should be documented in a licensee's decommissioning records under 10 CFR 50.75(g); to clarify how to report summaries of spills and leaks in a licensee's Annual

[31] DG-4012 was formally issued as Regulatory Guide 4.21, "Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning" in June 2008.

[32] In addition to the NRC's efforts, the nuclear industry collectively responded to these incidents of unplanned, unmonitored releases of radioactive liquids through the Industry Initiative on Groundwater Protection (Industry Initiative). The Industry Initiative has resulted in publication of voluntary industry guidance on the implementation of groundwater protection programs at nuclear power plants. *See* "Industry Ground Water Protection Initiative-Final Guidance Document," NEI-07-07, August 2007 (ML072610036); "Groundwater Protection Guidelines for Nuclear Power Plants: Public Edition, EPRI, Palo Alto, CA: EPRI Doc. No. 1016099, 2008.

Radioactive Effluent Release Report; to provide guidance on remediation of onsite contamination; and to upgrade the capability and scope of the in-plant radiation monitoring system to include additional monitoring locations and the capability to detect lower risk radionuclides. Further, Inspection Procedure 71122.01 has been revised to provide for review of onsite contamination events, including events involving groundwater; evaluation of effluent pathways so that new pathways are identified and placed in the licensee's Offsite Dose Calculation Manual, as applicable; and inclusion of limited, defined documentation of significant radioactive releases to the environment in inspection reports for those cases where such events would not normally be documented under current inspection guidance. *See* Implementation Status (ML073230982).

In addition, the NRC published a proposed rule that would, in part, amend 10 CFR Part 20 to clarify existing requirements by explicitly requiring licensees to conduct their operations to minimize the introduction of residual radioactivity into the site, including subsurface soil and groundwater. (73 FR 3812; January 22, 2008). This proposed rule also would include a requirement that licensees perform surveys to evaluate the concentrations and quantities of residual radioactivity and the potential radiological hazards of residual radioactivity detected. *Id*. While unmonitored unplanned releases continue to require the NRC's and licensees' attention, the NRC is confident that this issue will be adequately addressed through continued regulatory oversight of operating and new nuclear reactors and enhanced through the NRC's continued implementation of the Task Force recommendations. Therefore, the NRC continues to have assurance that no significant environmental impacts or safety concerns will result from extended storage in spent fuel pools.

2. Storage in Dry Casks.

With regard to dry cask storage, studies of the accident risk of dry storage since 1990 have focused on specific dry cask storage systems located at either a generic Pressurized Water Reactor (PWR) site or a specific Boiling Water Reactor (BWR) site. In 2004, the Electric Power Research Institute (EPRI) performed a Probabilistic Risk Assessment (PRA) of a bolted dry spent fuel storage cask at a generic PWR site. K. Canavan, "Probabilistic Risk Assessment (PRA) of Bolted Storage Casks Updated Quantification and Analysis Report," Electric Power Research Institute, Palo Alto, California; EPRI Doc. No. 1009691, December 2004. In 2007, the NRC published a pilot PRA methodology that assessed the risk to the public and identified the dominant contributors to risk associated with a welded canister dry spent fuel storage system at a specific BWR site. NUREG-1864, "A Pilot Probabilistic Risk Assessment of a Dry Cask Storage System at a Nuclear Power Plant," March 2007. Both studies calculated the annual individual radiological risk and consequences associated with a single cask lifecycle where the lifecycle is divided into three phases: loading, onsite transfer, and onsite storage. The EPRI study showed that risk is extremely low with no calculated early fatalities, a first year risk of latent cancer fatality of 5.6E-13 per cask, and subsequent year cancer risk of 1.7E-13 per cask. The NRC study also showed that risk is extremely low with no prompt fatalities expected, a first year risk of latent cancer fatality of 1.8E-12 per cask and subsequent year cancer risk of 3.2E-14 per cask. The major contributors to the low risk associated with dry cask storage are that they are passive systems, relying on natural air circulation for cooling, and are inherently robust massive structures that are highly damage resistant. Current design light water reactor (LWR) uranium oxide based fuel and carbon coated uranium oxide fuel of low burnup from a high temperature gas cooled reactor have been successfully stored in dry storage facilities for approximately 20 years. Extended dry-storage of this fuel has been approved for an additional

40-year term for facilities that have incorporated an appropriate aging management plan. Other potential new fuel types, such as fuels having different cladding alloys, fuel internal materials, new assembly designs, different operating conditions, or fuel higher than current burnup limits, can be approved by the NRC for extended storage provided that the applicant provides sufficient data to demonstrate that storage of the newer designs can be safely accomplished.

NRC and licensee experience to date with ISFSIs and with certification of casks has indicated that interim storage of spent fuel at reactor sites can be safely and effectively conducted using passive dry storage technology. There have not been any safety problems during dry storage. And the problems that have been encountered primarily occur during cask preparation activities, after initial loading of spent fuel, but before placement on the storage pad. One issue involved the unanticipated collection and ignition of combustible gas during cask welding activities. The NRC issued generic communications in 1996 addressing the problem and providing direction for preventing its recurrence. NRC Bulletin 96-04, “Chemical, Galvanic, or Other Reactions in Spent Fuel Storage and Transportation Casks,” and NRC Information Notice 96-34: “Hydrogen Gas Ignition During Closure Welding of a VSC-24 Multi-Assembly Sealed Basket.” NRC also revised its inspection and review guidance to ensure that appropriate measures are in place to preclude these events. *See* NRC Inspection Manual, Inspection Procedure 60854 Item 60854-02 and 02.03.a.6 and SFPO Interim Staff Guidance No. 15, dated January 10, 2001.

In addition, issuance of Materials License No. SNM-2513 for the Private Fuel Storage, LLC (PFS) facility has confirmed the feasibility of licensing an AFR ISFSI under 10 CFR Part 72. While there are several issues that have to be resolved before the PFS AFR ISFSI can be built

and operated,[33] the extensive review of safety and environmental issues associated with licensing the PFS facility provides additional confidence that spent fuel may be safely stored at an AFR ISFSI for long periods after storage at a reactor site.

In addition, as noted in its 1990 Waste Confidence Decision, the Commission has confidence in the safety and environmental insignificance of dry storage at an MRS for 70 years following a period of 70 years of storage in spent fuel storage pools. (55 FR 38509-38513; September 18, 1990). Specifically, the Commission stated:

> Under the environmental assessment for the MRS rule [NUREG-1092], the Commission has found confidence in the safety and environmental insignificance of dry storage of spent fuel for 70 years following a period of 70 years of storage in spent fuel storage pools. Thus, this environmental assessment supports the proposition that spent fuel may be stored safely and without significant environmental impact for a period of up to 140 years if storage in spent fuel pools occurs first and the period of dry storage does not exceed 70 years.

[33] For example, on July 17, 2007, Private Fuel Storage and the Skull Valley Band of Goshute Indians (the Band) filed suit against the U.S. Department of Interior (DOI) in federal district court, challenging DOI's decisions to disapprove the lease between PFS and the Band and to deny PFS's application for right-of-way across public land. On March 2, 2009, the court issued an Order resolving various discovery and administrative record disputes, and scheduling the filing of briefs addressing the merits of DOI's decisions; briefing should be complete by fall 2009. In addition, timely petitions for review challenging the NRC's decision to issue a license to Private Fuel Storage for the construction of an interim spent fuel storage facility were filed in the Court of Appeals for the D.C. Circuit. By Order dated June 27, 2007, the court held the petitions for review in abeyance pending further court order, requiring the parties to file status reports every 120 days on the status of actions challenging DOI's lease and right-of-way decisions. At the present time, the case continues to be held in abeyance. Another issue is associated with the February 2006 (NAS) Report on the transport of SNF in the United States, which concluded that while safe transport is technically viable, "the societal risks and related institutional challenges may impinge on the successful implementation of large-quantity shipping programs." National Research Council 2006, "Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States," Washington, D.C.: National Academy Press, TIC: 217588, at pp. 214. The NAS committee found that "malevolent acts against spent fuel and high-level waste shipment are a major technical and societal concern," and recommended that "an independent examination of security of spent fuel and high-level waste transportation be carried out prior to the commencement of large-quantity shipments to a federal repository or to interim storage." *Id*.

Further, a commenter on the 1990 Waste Confidence Decision asserted that there was reasonable assurance that spent fuel could be stored safely and without significant environmental risk in dry casks at reactor sites for up to 100 years. The Commission responded (55 FR 38482; September 18, 1990):

> The Commission does not dispute a conclusion that dry spent fuel storage is safe and environmentally acceptable for a period of 100 years. Evidence supports safe storage for this period. A European study published in 1988 states, "in conclusion, present-day technology allows wet or dry storage over very long periods, and up to 100 years without undue danger to workers and population (See Fettel, W., Kaspar, G., and Guntehr, H., "Long-Term Storage of Spent Fuel from Light-Water Reactors" (EUR 11866 EN), Executive Summary, p.v., 1988).
>
> Although spent fuel can probably be safely stored without significant environmental impact for longer periods, the Commission does not find it necessary to make a specific conclusion regarding dry cask storage in this proceeding, as suggested by the commenter, in part because the Commission's Proposed Fourth Finding states that the period of safe storage is "at least" 30 years after expiration of a reactor's operating license. The Commission supports timely disposal of spent fuel and high-level waste in a geologic repository, and by this decision does not intend to support storage of spent fuel for an indefinitely long period.

The Commission also explained the nature of its finding that spent fuel could be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation, stating (55 FR 38509; September 18, 1990):

> [I]n using the words "at least" in its revised Finding Four, the Commission is not suggesting 30 years beyond the licensed life for operation . . . represents any technical limitation for safe and environmentally benign storage. Degradation rates of spent fuel in storage, for example, are slow enough that it is hard to distinguish by degradation alone between spent fuel in storage for less than a decade and spent fuel stored for several decades.

As explained above under the discussion of Finding 3, the NRC has renewed three specific ISFSI licenses for an extended 40 year period under exemptions granted from 10 CFR Part 72,

which provides for 20 year renewals. In addition, NRC is considering a rulemaking that would provide a 40-year license term for an ISFSI with the possibility of renewal. *See License and Certificate of Compliance Terms,* 73 FR 45173; August 4, 2008. Continued suitability of materials is a prime consideration for ISFSI license renewals. As discussed under Finding 3 in this document, the applicants' evaluation of aging effects on the structures, systems, and components important to safety, supplemented by the licensees' aging management programs, provided reasonable assurance of continued safe storage of spent fuel in these ISFSIs. Thus, these cases reaffirm the Commission's confidence in the safety of interim dry storage for an extended period. While these license renewal cases only address storage for a period of up to 60 years (20 year initial license, plus 40 year renewal), studies performed to date have not identified any major issues with long-term use of dry storage. *See, e.g.,* NUREG/CR-6831, "Examination of Spent PWR Fuel rods after 15 Years in Dry Storage," (September 2003); J. Kessler, "Technical Bases for Extended Dry Storage of Spent Nuclear Fuel," Electric Power Research Institute, Palo Alto, California; EPRI Doc. No. 1003416, December 2002. (55 FR 38509; September 18, 1990).

3. Terrorism and Spent Fuel Management.

The NRC has, since the 1970s, regarded spent fuel in storage as a potential terrorist target and provided for appropriate security measures. Before September 11, 2001, spent fuel was well protected by physical barriers, armed guards, intrusion detection systems, area surveillance systems, access controls, and access authorization requirements for persons working inside nuclear power plants and spent fuel storage facilities. Since September 11, 2001, the NRC has significantly enhanced its requirements, and licensees have significantly increased their resources to further enhance and improve security at spent fuel storage facilities and nuclear

power plants. *See* Letter to Senator Pete V. Domenci from NRC Chairman Nils J. Diaz, dated March 14, 2005 (ML050280428) (Diaz Letter), at 20.

Consistent with the approach taken at other categories of nuclear facilities, the NRC responded to the terrorist attacks of September 11, 2001, by promptly developing and requiring security enhancements for spent fuel storage both in spent fuel pools and dry casks. In February 2002, the NRC required power reactor licensees to enhance security and improve their capabilities to respond to terrorist attacks. The NRC's orders included requirements for spent fuel pool cooling to deal with the consequences of potential terrorist attacks. These enhancements to security included increased security patrols, augmented security forces, additional security posts, increased vehicle standoff distances, and improved coordination with law enforcement and intelligence communities, as well as strengthened safety-related mitigation procedures and strategies. The February 2002 orders required licensees to develop specific guidance and strategies to maintain or restore spent fuel pool cooling capabilities using existing or readily available resources (equipment and personnel) that can be effectively implemented under the circumstances associated with the loss of large areas of the plant due to large fires and explosions. In January and April of 2003, the NRC issued additional orders on security, including security for spent fuel storage. The NRC subsequently inspected each facility to verify the licensee's implementation, evaluated inspection findings and, as necessary, required actions to address any noted deficiencies. The NRC's inspection activities in this area are ongoing. In 2004, the NRC reviewed and approved revised security plans submitted by licensees to reflect the implementation of new security requirements. The enhanced security at licensee facilities is routinely inspected using a revised baseline inspection program, and power reactor licensees' capabilities (including spent fuel pools) are tested in periodic (every 3 years) force-on-force exercises. Diaz Letter at iii, 7, 9.

In 2002, the NRC required power reactors in decommissioning, wet ISFSIs, and dry storage ISFSIs to enhance security and improve their capabilities to respond to, and mitigate the consequences of, a terrorist attack. In the same year, the NRC required licensees transporting more than a specified amount of spent fuel to enhance security during transport. Diaz Letter at 7, 8.

In 2002, the NRC also initiated a classified program on the capability of nuclear facilities to withstand a terrorist attack. The early focus of the program was on power reactors, including spent fuel pools, and on dry cask storage and transportation. As the results of the program became available, NRC provided licensees additional guidance on the Commission's expectations regarding the implementation of the orders on the spent fuel mitigation measures. Diaz Letter at iv.

More recently, on March 27, 2009, 74 FR 13926, the NRC issued a final rule to improve security measures at nuclear power reactors. In addition, in 2007 the NRC issued a final rule revising the Design Basis Threat, which also increased the security requirements for power reactors and their spent fuel pools (72 FR 12705; March 19, 2007).

i. Spent Fuel Pools.

Spent fuel pools are extremely robust structures that are designed to safely contain spent fuel under a variety of normal, off-normal, and hypothetical accident conditions (*e.g.*, loss of electrical power, floods, earthquakes, tornadoes). The pools are massive structures made of reinforced concrete with walls typically over six feet thick, lined with welded stainless steel

plates to form a generally leak-tight barrier, fitted with racks to store the fuel assemblies in a controlled configuration and provided with redundant monitoring, cooling, and make-up water systems. Spent fuel stored in pools is typically covered by about 25 feet of water that serves as both shielding and an effective protective cover against impacts directly on the stored fuel. Diaz Letter at 2; *The Attorney General of Commonwealth of Massachusetts, The Attorney General of California; Denial of Petitions for Rulemaking,* 73 FR 46206; August 8,2008 (*Denial of PRMs*).

The post September 11, 2001, studies discussed above confirm the effectiveness of additional mitigation strategies to maintain spent fuel cooling in the event the pool is drained and its initial water inventory is reduced or lost entirely. Based on this recent information and the implementation of additional strategies following September 11, 2001, the risk of a spent fuel pool zirconium fire initiation will be less than reported in NUREG-1738 and previous studies. Given the physical robustness of the pools, the physical security measures, and the spent fuel pool mitigation measures, and based upon NRC site evaluations of every spent fuel pool in the United States, the NRC has determined that the risk of a spent fuel pool zirconium fire, whether caused by an accident or a terrorist attack, is very low. In addition, the NRC has approved license amendments and issued safety evaluations to incorporate mitigation measures into the plant licensing bases of all operating nuclear power plants in the United States. *See Denial of PRMs,* 73 FR 46207-08; August 8, 2008.

ii. Dry Storage Casks.

Dry storage casks are massive canisters, either all metal or a combination of concrete and metal, and are inherently robust (*e.g.*, some casks weigh over 100 tons). Storage casks contain spent fuel in a sealed and chemically-inert environment. Diaz Letter at 3.

The NRC has evaluated the results of security assessments involving large commercial aircraft attacks, which were performed on four prototypical spent fuel cask designs, and concluded that the likelihood is very low that a radioactive release from a spent fuel storage cask would be significant enough to cause adverse health consequences to nearby members of the public. While differences exist between storage cask designs, the results of the security assessments indicate that any potential radioactive releases were consistently very low.

The NRC also evaluated the results of security assessments involving vehicle bomb and ground assault attacks against these same four cask designs. The NRC concluded that, while a radiological release was possible, the size and nature of the release did not require the Commission to immediately implement additional security compensatory measures. Accordingly, the NRC staff has recommended, and the Commission has approved, development of risk-informed, performance-based security requirements and associated guidance applicable to all ISFSI licensees (general and specific), which would enhance existing security requirements. This proposed ISFSI security rulemaking would apply to all existing and future licensees. *See* SECY-07-0148, "Independent Spent Fuel Storage Installation Security Requirements for Radiological Sabotage," (August 28, 2007) (ML080250294); Staff Requirements-SECY-07-0148-Independent Spent Fuel Storage Installation Security Requirements for Radiological Sabotage, (December 18, 2007) (ML073530119). In addition, the NRC has noted that distributing spent fuel over many discrete storage casks (*e.g.*, in an ISFSI) limits the total quantity of spent fuel that could potentially be attacked at any one time, due to limits on the number of adversaries and the amount of equipment they can reasonably bring with them. Diaz Letter at 17, 18, 22.

iii. Conclusion-Security.

Today, spent fuel is better protected than ever. The results of security assessments, existing security regulations, and the additional protective and mitigative measures imposed since September 11, 2001, provide high assurance that the spent fuel in both spent fuel pools and in dry storage casks will be adequately protected. The ongoing efforts to update the ISFSI security requirements to address the current threat environment will integrate the additional protective measures imposed since September 11, 2001, into a formalized regulatory framework in a transparent manner that balances public participation against protection of exploitable information.

4. Conclusion.

The Commission concludes that the events that have occurred since the last formal review of its Waste Confidence Decision in 1990 provide support for a continued finding of reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation of that reactor at its spent fuel storage basin. Specifically, NRC finds continued support for this finding in the extensive study of spent fuel pool storage that has occurred since 1990, and the continued regulatory oversight of operating plants, which has been enhanced by the recommendations of the Liquid Release Task Force.

Further, the Commission is revising Finding 2 to reflect its expectation that repository capacity will be available within 50-60 years of the licensed life for operation of any reactor. Consistent with this, the Commission is revising Finding 4 to reflect that spent fuel can be safely

stored in dry casks for a period of at least 60 years without significant environmental impacts. Specifically, the inherent robustness and passive nature of dry cask storage—coupled with the operating experience and research accumulated to date, the 70-year finding in the Environmental Assessment for the MRS rule, and the renewal of three specific Part 72 licenses for an extended 40-year period (for a total ISFSI operating life of at least 60 years)—support this finding. Further, this finding is consistent with the Commission's statements in 1990 that it did not dispute that dry spent fuel storage is safe and environmentally acceptable for a period of 100 years (55 FR 38482; September 18, 1990); that spent fuel could probably be safely stored without significant environmental impact for periods longer than 30 years (55 FR 38482; September 18, 1990); and that the 30 year finding did not represent a technical limitation for safe and environmentally benign storage (55 FR 38509; September 18, 1990).

Therefore, based on all of the information set forth above and after consideration of the public comments received, the Commission is revising Finding 4 as proposed.

C. Finding 4

The Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 60 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor in a combination of storage in its spent fuel storage basin and either onsite or offsite independent spent fuel storage installations.

V. Finding 5: The Commission finds reasonable assurance that safe, independent onsite spent fuel storage or offsite spent fuel storage will be made available if such storage capacity is needed.

A. Bases for Finding 5.

The focus of this finding is on the timeliness of the availability of facilities for storage of spent fuel when the fuel can no longer be stored in the reactor's spent fuel storage pool. At the outset of the Waste Confidence proceeding, there was uncertainty as to who had the responsibility for providing this storage, with the expectation that the Federal government would provide away-from-reactor (AFR) facilities for this purpose. But in 1981 DOE announced its decision to discontinue the AFR program. The Commission found that the industry's response to this change was a general commitment to do whatever was necessary to avoid shutting down reactors. The NWPA provided Federal policy on this issue by defining public and private responsibilities for spent fuel storage and by providing for an MRS program, an interim storage program at a Federal facility for utilities for which there was no other solution, and a research, development, and demonstration program for dry storage designed to assist utilities in using dry storage methods. These NWPA provisions, together with the availability of ISFSI technology and the fact that the Part 72 regulations and licensing procedures were in place, gave the Commission assurance that safe, independent onsite or offsite spent fuel storage would be available when needed. (49 FR 34686-34687; August 31, 1984).

In 1990, the Commission saw no need to revise this finding. It recognized that the NWPAA had undermined the ability of an MRS to provide for timely storage by linking the MRS to the siting and schedule for a repository (*i.e.*, DOE was not permitted to select an MRS site until it

had recommended a site for development as a repository). But the Commission found that whatever the uncertainty introduced by these NWPAA provisions, it was more than compensated for by operational and planned spent fuel pool expansions and dry storage investments by the utilities themselves. The Commission also considered the fact that it seemed probable that DOE would not meet the 1998 deadline for beginning to remove spent fuel from the utilities. This did not undermine the Commission's confidence that storage capacity would be made available as needed because NRC licensees cannot abrogate their safety responsibilities and would remain responsible for the stored fuel despite any possible contractual disputes with DOE. The Commission noted that DOE's research program had successfully demonstrated the viability of dry storage technology and that the utilities had continued to add dry storage capacity at their sites. Further, the Commission believed that there would be sufficient time for construction and licensing of any additional storage capacity that might be needed due to operating license renewals. (55 FR 38513-38514; September 18, 1990).

B. Evaluation of Finding 5.

In 1990, the Commission reaffirmed Finding 5 despite significant uncertainties regarding DOE's MRS and repository programs, and the potential for the renewal of reactor operating licenses. Specifically, in reaffirming Finding 5 the Commission stated:

> In summary, the Commission finds no basis to change the Fifth Finding in its Waste Confidence Decision. Changes by the NWPAA, which may lessen the likelihood of an MRS facility, and the potential for some slippage in repository availability to the first quarter of the twenty-first century . . . are more than offset by the continued success of utilities in providing safe at-reactor-site storage capacity in reactor pools and their progress in providing independent onsite storage. Therefore, the Commission continues to find '. . . reasonable assurance that safe independent onsite spent fuel storage or offsite spent fuel storage will

> be made available if such storage is needed.' (55 FR 38514; September 18, 1990).

In reaching this conclusion, the Commission stressed that—regardless of the outcome of possible contractual disputes between DOE and utilities—the utilities possessing spent fuel could not abrogate their safety responsibilities. In addition, the Commission cited three situations where dry storage had been licensed at specific reactor sites (Surry, H.B. Robinson, and Oconee), and several additional applications for licenses permitting dry cask storage at reactor sites. *Id*.

1. Operating and Decommissioned Reactors.

As in 1990, the NRC is not aware of any current operating reactor that has an insurmountable problem with safe storage of SNF. Spent fuel pool re-racking, fuel-pin consolidation, and onsite dry cask storage are successfully being used to increase onsite storage capacity. While there are cases where a licensee's ability to use an onsite dry cask storage option may be limited by State or Public Utility Commission authorities, the NRC is successfully regulating six fully decommissioned reactor sites that contain ISFSIs licensed under either the general or specific license provisions of Part 72. The NRC has not encountered any management problems associated with the ISFSIs at these six decommissioned reactor sites and has discussed plans to build generally licensed ISFSI's with two additional licensees that are in the process of decommissioning.

In addition, since 1990, the NRC has renewed the specific Part 72 ISFSI licenses for the Surry, H.B. Robinson and Oconee plants for an extended 40-year period, instead of the 20-year renewal period currently provided for under Part 72. As discussed above under Finding 3, the

Commission authorized the staff to grant exemptions to allow the 40-year renewal period after the staff reviewed the applicants' evaluations of aging effects on the structures, systems, and components important to safety and determined that the evaluations, supplemented by the licensees' aging management programs, provided reasonable assurance of continued safe storage of spent fuel in these ISFSIs. *See* SECY-04-0175, "Options for Addressing the Surry Independent Spent Fuel Storage Installation License-Renewal Period Exemption Request," September 28, 2004 (ML041830697).

With regard to the uncertainty surrounding the contractual disputes between DOE and the utilities referenced by the Commission in 1990, the U.S. Court of Appeals for the District of Columbia Circuit has since held that DOE's statutory and contractual obligation to accept the waste no later than January 31, 1998, was unconditional. *Indiana Michigan Power Co. v. DOE,* 88 F.3d 1272 (D.C. Cir. 1996). Subsequently, the utilities have continued to manage spent fuel safely in spent fuel pools and ISFSIs and have received damage awards as determined in lawsuits brought before the U.S. Federal Claims Court, *see, e.g., System Fuels Inc. v. U.S.,* 78 Fed. Cl. 769 (October 11, 2007).

In total, there are currently 51 licensed ISFSIs being managed at 47 sites across the country, under either specific or general Part 72 NRC licenses. As explained in the discussion of Finding 3, NRC's inspection findings do not indicate unique management problems at any currently operating ISFSI regulated by the NRC. Generally, the types of issues identified through NRC inspections of ISFSIs are similar to issues identified for Part 50 licensees. Most issues are identified early in the operational phase of the dry cask storage process, during loading preparations and actual spent fuel loading activities. Once an ISFSI is fully loaded with

spent fuel, relatively few inspection issues are identified due to the passive nature of these facilities.

2. New Reactors.

With regard to the status of contracts requiring DOE to take title to and possession of the irradiated fuel generated by utilities, DOE has prepared updated contracts, and a number of utility companies have signed contracts with the department. In addition, before licensing a new reactor, the NRC must find that the applicant has entered into a contract with DOE for removal of spent fuel from the reactor site or receive written affirmation from DOE that the applicant is actively and in good faith negotiating with the DOE for such a contract. NWPA, Sec.302(b). This finding will be documented in the Safety Evaluation Report produced by the NRC staff in response to specific license applications for new reactors.

The near-term design certifications and existing or planned combined license applications do not undermine the Commission's confidence that spent fuel storage will become available when such storage is needed. These facilities will use the same or similar fuel assembly designs as the nuclear power plants currently operating in the United States, and the spent fuel will be accommodated using existing or similar transportation and storage containers. As discussed under Finding 1, the NRC is also engaged in preliminary interactions with DOE on advanced reactors (*e.g.*, gas-cooled or liquid-metal cooled technologies). The fuel and reactor components associated with some of these advanced reactor designs would likely require different storage, transportation and disposal packages than those currently used for spent fuel from light-water reactors. The possible need for further assessment of performance and storage capability for new and different fuels would depend on the number and types of reactors actually

licensed and operated. There is currently high uncertainty regarding the construction of advanced reactors in the U.S. In addition, the need to consider waste disposal as part of the overall research and development activities for advanced reactors is one of the issues being considered by DOE, reactor designers, and the NRC (*see*, for example, "A Technology Roadmap for Generation IV Nuclear Energy Systems," issued by the U.S. DOE Nuclear Energy Research Advisory Committee and the Generation IV International Forum, December 2002).

Nonetheless, the addition of new plants will undoubtedly add to the amount of spent fuel requiring disposal. This fact does not affect the Commission's confidence that safe storage options will be available when needed because, as the Commission stated in 1990, utilities have sought to meet storage capacity needs at their respective reactor sites. (55 FR 38514; September 18, 1990). Specifically, as discussed under Finding 3, NRC licensees have successfully and safely used onsite storage capacity in spent fuel pools and, more recently, in onsite ISFSIs licensed under 10 CFR Part 72. In addition, while construction and operation of an MRS facility by DOE is uncertain, the NRC has promulgated regulations that provide a framework for licensing such a facility. *See* 10 CFR Part 72; (53 FR 31651; August 19, 1988). Further, while there are unresolved issues that are currently preventing construction and operation of the PFS facility, the extensive safety and environmental reviews that supported issuance of an NRC license for PFS provide added confidence that licensing of a private AFR facility is technically feasible.

The Commission concludes that the events that have occurred since the last formal review of the Waste Confidence Decision in 1990 support a continued finding of reasonable assurance that safe independent onsite spent fuel storage or offsite spent fuel storage will be made available if such storage capacity is needed. Specifically, since 1990, NRC licensees have

continued to develop and successfully use onsite storage capacity in the form of pool and dry cask storage in a safe and environmentally sound fashion. With regard to offsite storage, the Commission licensed the PFS facility after an extensive safety and environmental review process and a protracted adjudicatory hearing that resulted in over 70 ASLB and Commission decisions. The Commission also has a regulatory framework for licensing an MRS facility, should the need arise. In addition, DOE has prepared updated contracts to provide for disposal of spent fuel and a number of utility companies have signed contracts with the department. This provides the NRC with continued confidence in the Federal commitment to providing for the ultimate disposal of spent fuel.

Based on the above discussion, including its response to the public comments, the Commission reaffirms Finding 5.

Dated at Rockville, Maryland, this XX day of June 2009.

For the Nuclear Regulatory Commission.

/RA/

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Annette Vietti-Cook,
Secretary of the Commission.